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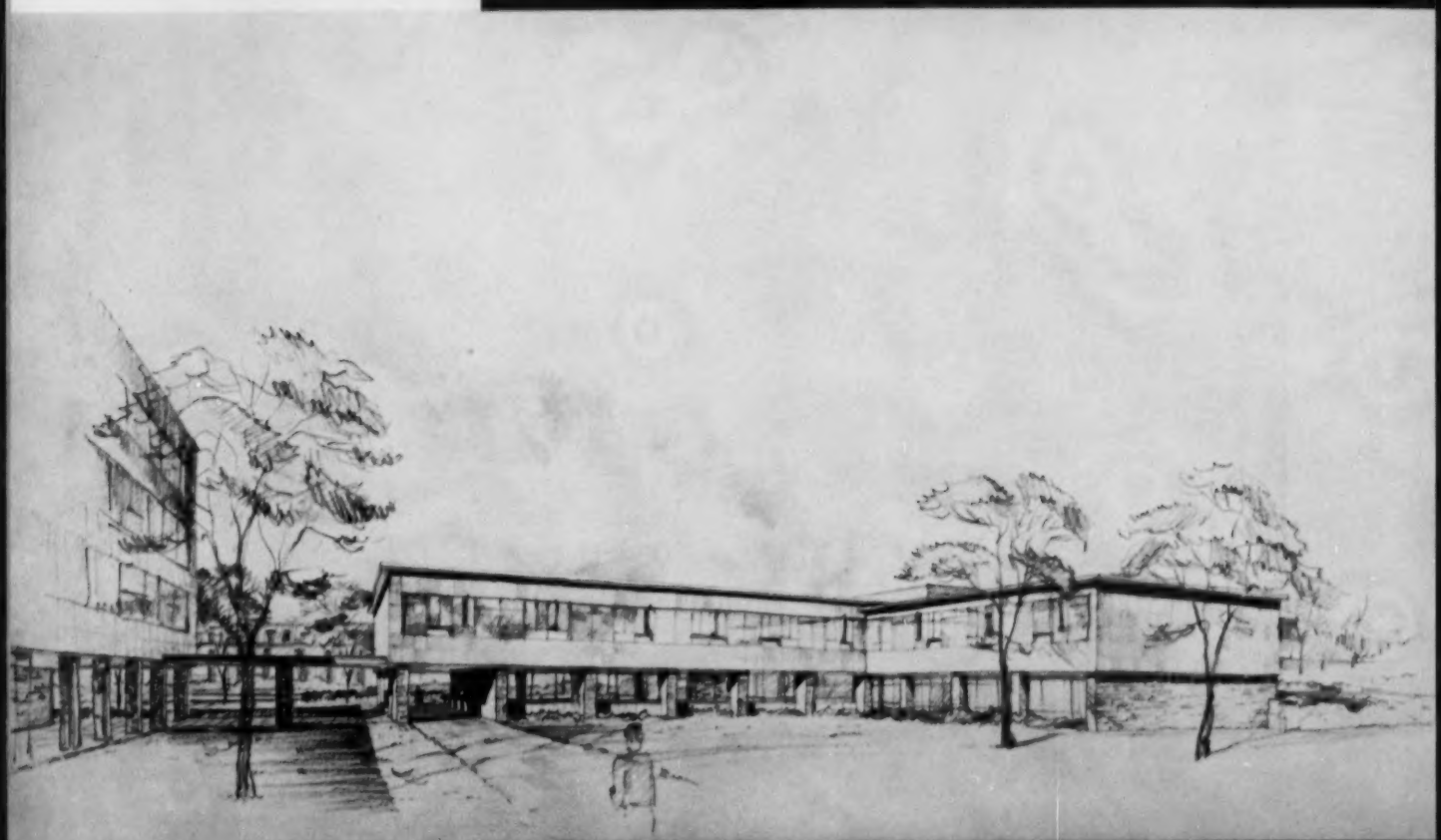

JANUARY, 1956
VOL. 21, NO. 4
25 CENTS

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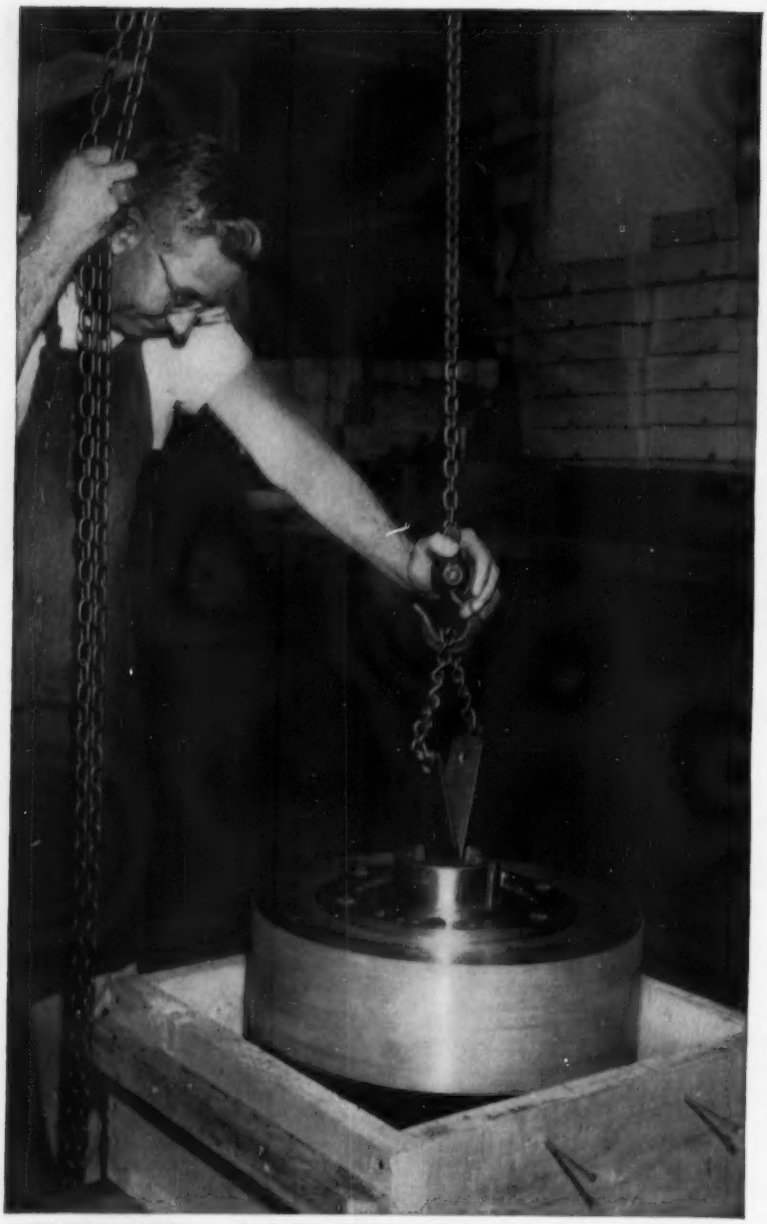

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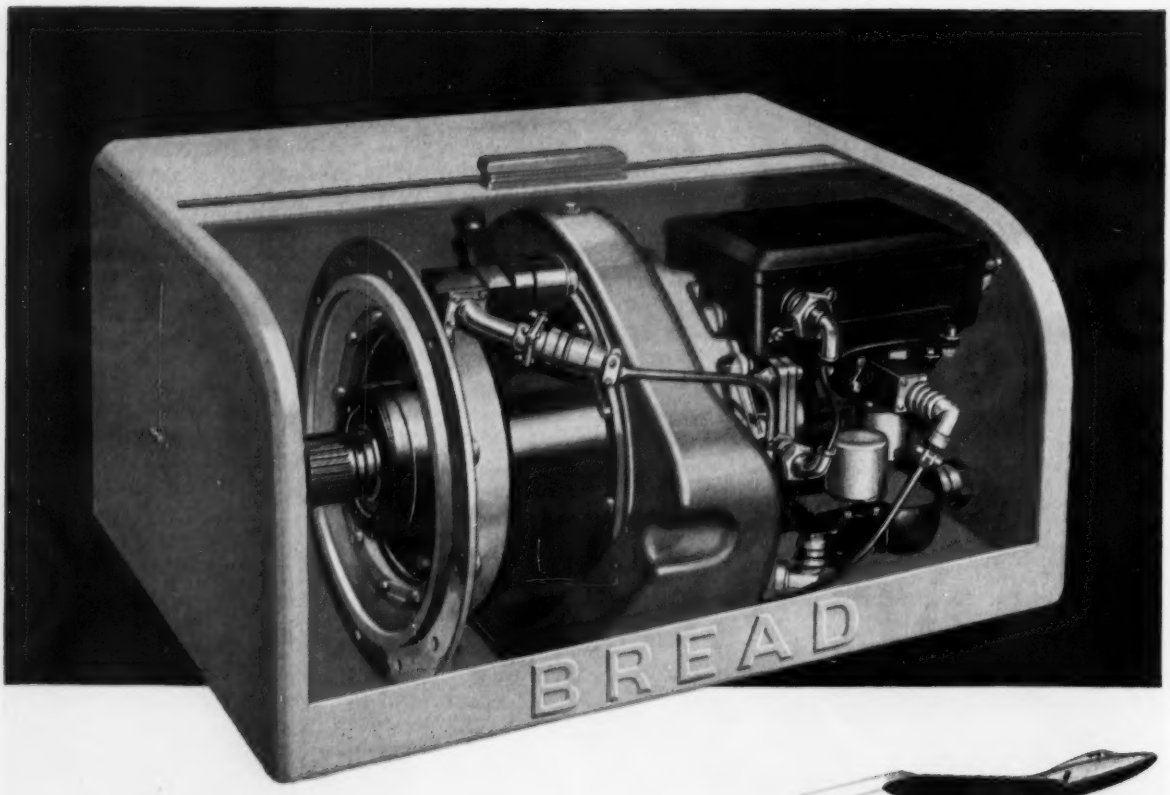

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COVER: Drawing of new administration building and library for the Engineering School.

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Science and Religion

by

Dr. Allen C. Best

Had this article been written a century ago it would have been entitled in all probability—*Science Versus Religion.* Few thought of science and religion meeting on common grounds during the heated controversies between science and theology in the Nineteenth Century. Great was the battle that raged over such issues as: Will religion have to surrender to science? Does evolution contradict the claims of religion and deny the Bible? Are the experiments of scientists irreverent meddling with the spiritual order of things? It is strange that the college campus served as a storm center for the science versus religion controversy since higher education at the time was closely related to religion. The great universities and colleges of the day were founded to train ministers, rabbis and priests for the church and synagogue. Harvard is typical. It was founded in 1639 and its main purpose, inscribed above the main gate to Harvard Yard, was to avoid leaving "an illiterate Ministry to the Churches, when our present Ministers lie in the dust."

The battle between science and theology reached its peak in the twenties and early thirties when doubt rode high and man was certain he could save himself by his own efforts and progressive education. Secularism was then substituted for religion and it was believed that man was too inherently good and too far advanced to fight another world war. Then came Hitler's blast furnaces and concentration camps, Mussolini's bombings of innocent Ethiopians, Stalin's Siberia, Hiroshima, and thinking people began to wonder if man's inherent goodness and ability to save himself by his own efforts were not more fiction than fact.

The pathetic collapse of liberal optimism regarding man's nature and endeavors in that age of mass murder had a sobering influence upon all of the disciplines and may account for science and theology taking a fresh look at each other and the thing called man they serve. At any rate, during and since World War II "The conflict between religion and science and between secular and divine scholarship has faded away. The great scientists themselves, to the surprise of some partisans of the anti-religion camp, turned out to be deeply religious men. 'God does not play dice with the universe,' said Albert Einstein."[1] "Science for Science Sake" was frequently heard at the height of the historic "science-theology" struggle. Then, it seemed as though science assumed no moral responsibility for its work beyond its experiments and discoveries. Science's new moral concern, however, has been echoed by such men as Dr. David Lilienthal, former chairman of what is perhaps the most important commission in the world, The Atomic Energy Commission, who wrote: "The purpose of research must be a moral, an ethical one . . . Research must have a soul. Intelligence is not enough without a spiritual and human purpose."[2]

Four basic realizations seem to characterize the new appreciation of science and religion for each other. They are: (1) The realization that man requires something beyond himself and the materialistic advancements of science in which to believe and to complete himself as a mature human being; (2) The realization that, while science has added much to our comfort and the efficiency by which things get done, it takes more than the mechanical advantages of a scientific age to make an honest man, an integrated personality, or a healthy and happy person; (3) The realization that men must live together in world community in spite of their differences, and that this community will not be permanently achieved through discipline which fear of the hydrogen bomb imposes from without the individual, but rather from discipline which commitment to ideals imposes from within the individual; and, (4) The realization that science and high religion must come to deeper appreciation of each other if civilization is to survive and to advance in this nuclear and technological age.

No one is so naive as to suggest that all the die-hards in religion or science have or will accept the

Anabel Taylor Hall

—*Photo Science*

new look in science-religion relationships. There are, however, growing indications that mature leadership in both disciplines see the problems and solutions more clearly than ever before and there is and will continue to be a deepening appreciation of each other. Neither would one contend that science is ready to embrace all of formalized religion nor that religion is ready to accept all of the implications and conclusions of science and its related fields. Gone, however, are the old fears of science and religion for one another. Mature religion does not fear science and its discoveries, but welcomes both as allies in the search for truth. The same can be said of mature science. Certain observations, growing out of the real or alleged conflict between theology and science, therefore, may help the two disciplines adjust to each other, and give individuals a deeper appreciation of the issues between science and religion.

It has been observed by both believers and unbelievers, scientists and religionists, that there is no real basis for much of the so-called conflict between science and theology. Dr. Peter Alexander, The University of Leeds, England, himself an unbeliever, expressed recently what many, particularly those trained in both science and religion have come to feel. He wrote:

> It is the DUTY of a Devil's Advocate to put the opposing case as strongly as possible. It would perhaps be pleasant and exciting if I could arouse the sort of storm for which the Nineteenth Century discussions of science and religion are notorious, but I fear I shall be unable to do this. I hope that I shall not be thought, therefore, to have failed in my task. I am unable to do it because I believe that many of those discussions were mistaken in assuming a conflict where none existed. I do not think that there is, or need be, a serious conflict between science and religion, in the sense that new discoveries in science can threaten the essential beliefs of Christianity. I do not mean that there was a dispute which has been settled in one way or the other, in favour of science or religion, but that it was never a real dispute. There can be no question of refusing to accept, on religious or theological grounds any established scientific statement, but this need hold no terrors for the theologian since he can consistently accommodate any such statement without being untrue to his faith.
>
> But it may be asked, if there is no conflict, no real dispute, why should we waste time discussing it? There is a very good reason. There are many people for whom the alleged conflict still seems a real one, and if they can be led to see its unreality, so much the better for both their science and their religion. It may be perennially necessary to deny the conflict, for I suspect that the belief in it survives because people want it to survive.[3]

Science and religion's chances of sharing together are much greater if it is realized that they are dealing with different kinds and concepts of knowledge, reality, and values. Dr. I. G. Whitchurch interprets the problem:

> . . . The conflict, however, is inadequately conceived as one between science and religion. It actually generates about two radically different theories of knowledge and of reality. Instead, therefore, of falling back upon the device of assessing praise and blame upon scientists or religionists, let us by the help of historical reference try to improve our understanding of this epoch-making controversy. To begin with, we must bear in mind the different primary emphases of the religious and of the scientific mind. Such a difference of accent arises very naturally from the work which each undertakes to perform. As of old religion concentrates upon the problem of human values in their ultimate significance. The sciences, on the other hand, seek to understand the order of nature, its laws and their meaning for human behavior . . . In our historical perspective the religionist has been bent upon coming to terms with deity, with human destiny. Hence the issue of dependable knowledge never got out into the open on the same level of concern. Likewise, the scientist has been so extensively absorbed in checking observation and experiment —in the extension of one kind of knowledge—that he has scarcely seen the human problem in its total context.[4]

The problem of knowledge and reality is older than the "science-theology" conflict. "What do we know? How do we know? What is real?" raise problems as old as man's first attempt to answer the "whys" and "wherefores" of life. Space does not permit us to deal extensively with these questions. It will suffice to say that science deals primarily with tangible values; that what is knowable and real for science, if it remains true to the scientific method, is what can be described and controlled in the laboratory. Religion deals primarily with intangible values and while it recognizes the validity of science's descriptive knowledge, it cannot accept it as the only kind of knowledge. Neither will it accept all of the speculative conclusions regarding the nature of life frequently drawn from such facts. Religion further argues that the scientist as a human being does not and cannot live soley by the scientific method. What scientist ever thought the scientific method and the kind of knowledge it brings into focus could adequately describe his love for his wife or the reality he finds in relationships with his children and close friends? What scientist ever said, "I will not marry until I can fully describe, understand and control my lady-love?" In the matter of love the scientist, as a human being, acts from the same set of references and kinds of knowledge as the rest of mankind. He accepts as real what can never be described in a test tube. But does this differ greatly from the basic, ultimate assumptions and speculations of science? Not if we can accept the word of Dr. Warren Weaver, noted scientist, mathematician, educator, and Director of the Division of Natural Sciences and Agriculture of the Rockefeller Foundation, who wrote:

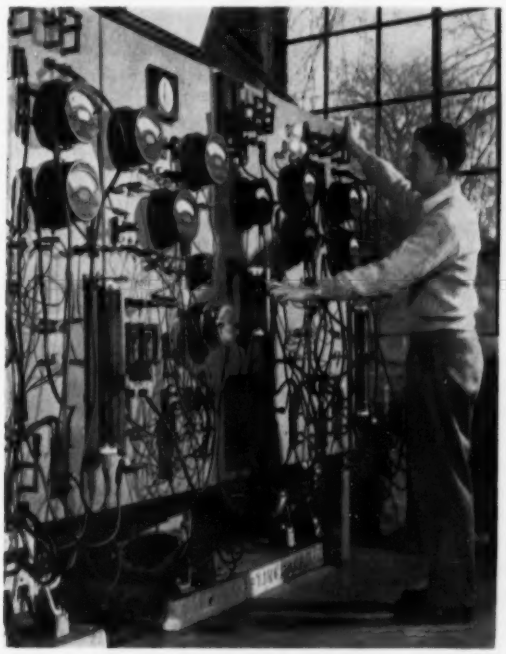
> When he (the scientist) forces his thinking down to basic levels, a wholly new and strangely abstract set of ideas come into play. Solids are not really solid. "Real objects" are not even composed, as physicists thought a half-century ago, of submicroscopic atoms like billiard balls.
> Consider the electron, for example. For a while physicists thought it was a particle. (You mustn't really ask what "particle" means, any more than you should ask just what it means when you say God has certain

"A University cannot ignore this: The most prominent thing, probably, in any culture is its religion."

Nathan M. Pusey, *President*
Harvard University

"As the scientist learns more and more, he must be more and more conscious of the Infinite, more and more humble of his own small knowledge, and more and more dependent on faith; faith in the significance of human life and activity and progress; faith in truth itself, or shall we say faith in God?"

Dr. Robert V. Kleinschmidt, A.B., A.M., B.S., Sc.D.
Professor of Physics and Mechanical Engineering
Harvard University



—*Photo Science*

Students at Cornell University may search for truth in places of worship like Anabel Taylor Hall Chapel, and in laboratories of pure and applied science.

human characteristics.) Then physicists realized that electrons are wave motions. (Wave motions of what? Well, it isn't useful to ask this question, either.) Today, physicists think electrons as being both (or either) particles or waves . . .

Or suppose you carry out careful measurements and consult the best theories of physics to determine what an electron is going to do next. Well, it turns out that you can only say what it is likely to do next. Science can predict with great definiteness on large-scale, everyday sort of phenomena; but this definiteness fades away and vanishes as you proceed down the scale of size, to individual events . . .

All this may seem funny or ridiculous to you. But you had better not jump to unwise conclusions. Science may move on to more advanced views of the ultimate nature of things; but there is not the slightest promise that the "improved" view can be any less abstract. Most scientists, I think, have had to come to an entirely new concept of what "explaining," "understanding," or "defining" really means. And this holds for science no less than religion.[5]

Then he adds:

I am trying to explain whether or not a scientist can believe in God. To do this, I am trying to explain the way scientists think. And we find that a scientist is, by his training, specially prepared to think about things in two ways: the everyday way, and a second way which is a deep, logical, restless, and detailed way. In this second way of thinking, the scientist is forced to live with very abstract ideas. He has come to feel their value and their inevitability. He has developed skepticism concerning easy answers or the "obvious" nature of events. He is the last to expect that an "ultimate explanation" is going to involve familiar ideas. He is convinced, moreover, that reality is not simply denseness or visibility, hardness or solidity. To the scientist, the real is simply what is *universally experienced.*

Does this sound abstract and difficult? Of course it does: The scientist knows that when he is pushed back to a point at which his thinking should begin, he is forced to deal with difficult abstractions. A scientist is just the one who should not say that an abstract concept of God results in an "unreal" God. For the scientist knows that the everyday reality of the table and the rock is an illusion, and that reality is in fact a very subtle, evasive, and somewhat abstract business.[6]

Misunderstanding between science and theology has been caused by loose, sentimental thinking. This is not to deny that there are basic differences between the two which are difficult to reconcile. Nowhere has loose, sentimental thinking been more evident than in the definitions of the scientific method and religion. The assumption that the scientific method is a method of final proof has clouded communications between science and religion. The scientific method is basically a descriptive method and when the scientist goes beyond the descriptive process or his controlled area of investigation, he becomes a prophet, philosopher or speculator. This does not discredit the value of speculation, but it says that in the attempt to answer what is ultimately real and basic, the scientist is not far removed from the religionist.

Religion likewise has been loosely defined. Definitions range from man's devotion to a god or gods to a general orientation to that which

"The enlightenment of science deepens the significance of spiritual worship, belief in the value of human life, in the unity of human culture."

Dr. Alfred L. Kroeber
University of California

controls his interest, motivates his actions or inspires his solitary thoughts. This latter, if carried to its absurd ends, might well include a man's mother-in-law, hunting dog or favorite fishing rod. Others attempt to avoid science's searching questions by claiming that religion is too "highly personal to define." Religionists are also guilty of speaking of the "almighty dollar" as being a man's religion or god. The "almighty dollar" can never be a man's god in the historic Hebraic-Christian concept of God anymore than a golf club can be President Dwight Eisenhower. A man's dependence or over-dependence upon money is just that and nothing else. Mere orientation, devotion or adjustment to an idea does not constitute religion, any more than a philosophy of life makes a man religious. These orientations and philosophies, however, may serve adjustment roles similar to religion in man's life. Religion basically and by historic definition is simply that which man does with the idea of God or gods. Westermarck defines religion as "a regardful attitude toward a supernatural being on whom man feels himself dependent and to whom he makes an appeal in worship." William James interpreted religion in much the same language: "Religion is the feelings, acts and experiences of individual men in their solitude, so far as they apprehend themselves to stand in relation to whatever they may consider the Divine." It is understandable that the practical scientific mind should reject illusive definitions that make religion all things and nothing specific. This is not the way the scientist thinks.

The conflict between science and theology has its personal elements. Some use it as a scapegoat and a sophisticated way of rationalizing unsolved personal problems and immature living. While personal problems have nothing to do about the philosophical and theoretical problems between science and theology, they can make intelligent sharing difficult between the two disciplines because they cloud the real issues. Persons reacting strongly against either science or religion may be doing so for emotional and not intellectual reasons. Among students rebellion against parents and rebellion against one's self over moral failures are frequent causes of rebellion against religion. Such persons evade the real issue by claiming that exposure to scientific knowledge destroyed their faith in God and religion.

Science escapes one problem that constantly plagues religion. It is the way people write off religion without giving it an honest try. High religion asks no special privileges. It asks only to be tried in the laboratory of life. Said Jesus, "If any man will do His (God's) will, he shall *know* . . . " John 7:17. Religionists believe this is a good place for anyone to begin his search for God, but what they frequently find are experiences like Bertrand Russell's:

> I continued to believe devoutly in the Unitarian faith until the age of fourteen, at which period I became exceedingly religious and consequently anxious to know whether there was any good ground for supposing religion to be true. For the next four years a great part of my time was spent in secret meditation upon this subject; I could not speak to anybody about it for fear of giving pain . . . I continued to believe in God until the age of eighteen, since the First Cause argument appeared to me to be irrefutable. At eighteen, however, the reading of Mill's autobiography showed me the fallacy in this argument. I therefore definitely abandoned all the dogmas of Christianity.[7]

Dr. James D. Smart, commenting upon this confession, writes:

> For four years, as an adolescent boy, he broods over his religion. He has drawn his knowledge of Christianity only from his boyhood contacts with Unitarians. During his four years of meditation he admittedly speaks to no one on the matter. He makes no mention of reading the source material in the Bible. Then, with the accumulated wisdom of eighteen years, he renounces Christianity once and for all. Not only does he renounce it, but he becomes a bitter antagonist of Christianity.[8]

Then Dr. Smart asks:

> In what realm of human learning would a man be accepted as one entitled to speak with authority who had given the subject only the uninformed, introverted, brooding consideration of a few boyhood years?[9]

If to be scientific means to investigate a subject thoroughly before pronouncing judgment, then it seems reasonable to suggest that a person should investigate religion

About the Author

Dr. Allen C. "Rusty" Best has been a Chaplain and counselor at Cornell University since 1942. In addition to being personally responsible for the religious program serving the nearly 1500 Methodist students at Cornell and Ithaca College, Dr. Best helps administrate the general program of Cornell United Religious Work. He has been Director of the New York State Methodist Student Movement since 1944. Dr. Best holds degrees from Syracuse University, Boston University School of Theology, and Boston University Graduate School.

With a thorough background in applied psychology and vocational guidance, Dr. Best is competent in student guidance work, cooperating with the Deans of men and women, medical staff, administration and student governing boards. He is active in lecturing, preaching, and teaching courses for students in religion and marriage.

thoroughly before passing final judgment upon it. High religion welcomes the honest, doubting mind, but it is suspicious of the mind that accepts ignorance as an excuse for doubt. A student once said to a Jewish Rabbi, "I have had some science and am about to become an athiest. First, however, I want to talk to you." The rabbi asked three questions of the student, "Have you read the Old Testament?" "Have you read Jewish philosophers?" "Have you read Jewish theologians?" When to each question the student replied, "No," the rabbi said: "Young man you are not an athiest, you are an ignoramous." Unfortunately the story pin-points a predicament common to many students and may reflect education's failure to deal as adequately in the realm of religious knowledge as in the technical sciences.

We began by suggesting the time has long passed to speak of science versus religion. We entitled this article, *Science and Religion,* because we believe these great disciplines must work together for the good and advance of civilization. We believe that science has contributed much to high religion, but we also believe that our technological age is doomed to failure unless man's spiritual development keeps abreast of his mechanical advances. We believe religion has much to offer our technical age, because we believe there must be morally responsible people to handle wisely the advances of science. When fifteen hundred practicing engineers were asked to list the most essential qualities of a successful engineer, the results were as follows:

"1. Character	41%
2. Judgment	17½%
3. Efficiency	14½%
4. Understanding of human nature	14%
5. Technical knowledge	13%"[10]

If these figures are indications of the thinking of our scientists, then education had better take seriously the matter of character development and the preparation of people to live together.

We should know now that mere technical knowledge can never be enough or why has it not saved this generation from sin, folly, alcoholism, mental disorders, family breakdowns and wars. We should know now that education that does not prepare for life "in the broad sense of completeness as a human being, rather than in the narrow sense of competence in a particular field," is not good education. We should know now that education that leaves out moral purpose can be dangerous and destructive to both the individual and the community. We should know now that high religion deals with man's most fundamental questions about life and can give moral direction to world recovery. They are not too wrong who contend that the predicament of modern man is theological for history has shown that when the Hebraic-Christian culture decays, what follows is not a noble humanism seeking social justice and peace, but a resurgent paganism that destroys values, peace and life. Man will worship something. If he does not worship a Hebraic-Christian God with its high code of ethics, its concern for the individual and the good of mankind, then he will worship the golden calf, Mars, the state, or his own achievements.

There has not been a lack of educational opportunities, technical know-how, or material wealth in the present crisis, but there has been a noticeable absence of concern for human freedom, the lack of fundamental honesty, and a disrespect for the sacredness of life—all spiritual values upon which man's happiness and survival depend. That is why we believe that science and religion should strive together in a common quest to enrich life.

FOOTNOTES

1. Fred M. Hechinger, "It's No Longer Science VS. Religion," THIS WEEK MAGAZINE, October 2, 1955
2. David Lilienthal, "Research has Moral Responsibility."
3. Peter Alexander, "The Difficulties Which the Scientist Experiences In Accepting Theological Statements," THE CHRISTIAN SCHOLAR, September, 1955
4. Ira G. Whitchurch, "Interpreting the Religious Situation", p. 3
5. Warren Weaver, "Can a Scientist Believe in God?", A GUIDE TO THE RELIGIONS OF AMERICA, pp. 161 ff.
6. Ibid—p. 163
7. Bertrand Russell, Living Philosophies, pp. 9ff
8. James D. Smart, What a Man Can Believe, pp. 43ff
9. Ibid p. 44
10. Carroll V. Newsom, "Summation," What Should Education Be Doing in 1954? The Thorne Lectures, p. 60.

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THE ENGINEERING COLLEGE EXPANDS

by
DANIEL R. HUNTER
ChemE '58

From the founding of the University and the construction of the first building on campus to the present day, the history of the architecture of Cornell parallels its rise to prominence as a great educational institution. In the days when Ezra Cornell conceived the idea for the University which bears his name, many land grant institutions were springing up through out the nation. Cornell shared the benefits of both this type of university and also of the privately endowed college. The establishment of the land grant provided for instruction in "such branches of learning as are related to the mechanic arts." It was due to this clause that the early administration incorporated into its program of studies the basis for the modern engineering curricula which we know today.

It was, however, in large part, due to the generous endowments of many alumni and friends of the University that the buildings and laboratories needed to activate this program were realized. As the University grew, and as its alumni rose to new heights in their respective fields, graduates continued to endow Cornell with the monetary means to expand, and to offer to the engineering student the most advanced facilities possible to prepare him for a career in his chosen profession. In a sense then, the engineering buildings also parallel the rise of technology in our nation. Many of the college's alumni have distinguished themselves in the applied sciences after being given a thorough background by the college faculty in the physical facilities so generously donated by their predecessors. As technology expands, so do the facilities of the Engineering College, and likewise the number of highly competent engineers that Cornell is able to send to the many industries of the world. It is fairly safe to assume that endowments to the College of Engineering will continue to accumulate and as a result its laboratories and classrooms will continue to be among the most advanced and best equipped in the world.

The campus of today is a far cry from Ezra's farm overlooking blue Cayuga. The lake is still blue, but it is doubtful if even our foresighted founder could have envisioned so great a number of buildings as have been erected on his once barren cornfield. The architecture of Cornell, like almost every other aspect of the University, is extremely varied. Almost every innovation in building style from the middle of the nineteenth century to the mid-twentieth is represented, interspersed throughout with the aesthetically stable influence of modern Gothic.

Sibley Is First Engineering Building

The first building to be erected on campus was built in 1868, and only three years later, the first engineering building, Sibley Hall, opened its doors. Here were the classrooms for those who had entered the University to study the "mechanic arts"; and to this day, it has been the headquarters of Cornell's School of Mechanical Engineering, as well as housing the offices of the College of Engineering. Generations of Cornellians, in pursuit of higher learning have become familiar with the sight of the fabled Sibley Dome which surmounts the structure. Visible from many remote parts of the campus, the "Dome" serves as a reminder to those who gaze upon its ornate symmetry that the founders of the University recognized the need for applied science as well as the humanities in a progressive university program.

The building was a gift of Hiram W. Sibley, who together with his friend, Ezra Cornell, had established the Western Union Telegraph

Co. Cornell himself had devised the system of placing telegraph wires on poles. This was done in order to keep them away from the moist ground in the days when insulation was relatively poor. It was fortunate for the University that a man with this practical background should be its founder, and should incorporate into his new program of studies the means to educate men who desired to become skilled in the application of the sciences. It was also fortunate that through Western Union he became acquainted with Sibley, since from this acquaintance resulted the first engineering building on the new campus.

Adjacent to Sibley, on the North End of the main quad is Franklin Hall, which from 1883 until 1954 was the home of the electrical engineers. From this hall have gone forth hundreds of young men, eager to explore the mysteries of everything electrical from the first dyamo to the complex computer. Cornell was the first institution on record to grant a degree in electrical engineering. This was in 1885, just two years after the completion of Franklin. Much to the dismay of many, however, the knowledge of electricity has greatly increased, and five years of rewarding instruction are now required for the same degree. The electrical engineers have since moved into their modern building on the new engineering campus, which will be discussed more fully in a later section.

The next engineering building was erected in 1888, and was located on the eastern side of the main quadrangle, proximate to Sibley and Franklin Halls. This was Lincoln Hall of Civil Engineering. It is still the home of the CE's, but will be vacated in the next few years when the proposed Civil Engineering building is completed. Lincoln Hall contains, besides the classrooms for engineering instruction, the laboratories for aerial photographic survey, microbiology, numerous smaller labs for research in town and highway planning, and other labs for study in specialized fields pertaining to Civil Engineering.

As can be seen by noting the dates of completion of these buildings, they were all built before the twentieth century. From this time until the mid 1930's no extensive facilities were erected or proposed by the College of Engineering. Smaller buildngs were erected as wings of the older structures or as separate units close to the main buildings. For fifty years, the engineering buildings were considered adequate to meet the demands of training engineers for our nation's industries. The period of stagnation came to a close when university officials realized that the rise of technology and need for engineers in the nation was far in advance of the physical facilities with which to meet this demand. They also became aware that in order for Cornell to continue its training of highly qualified engineers, the most modern facilities possible would have to be offered to its undergraduate and advanced students. The actual planning for the new group of engineering buildings began in the 1930's when the planners of the new venture began the search for funds and for a satisfactory site on the greatly expanded campus.

Trustees Approve New Quadrangle

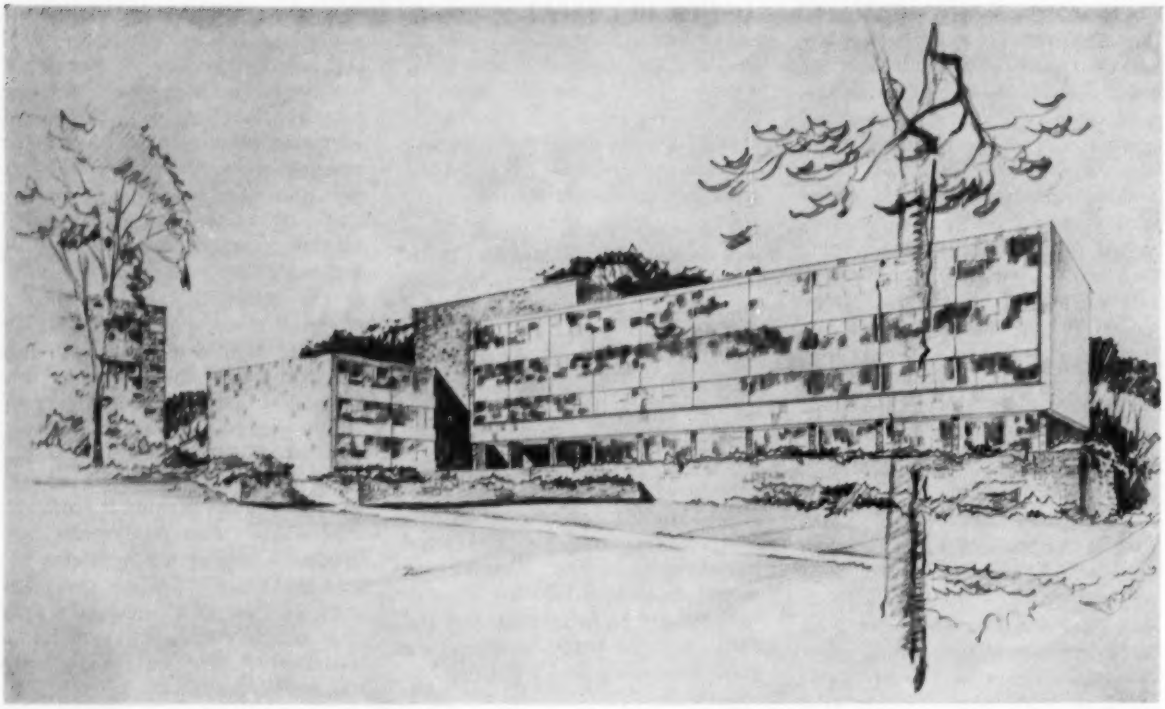
In 1940, the Trustees approved an area on the South campus, extending from Hoy Field to Myron Taylor Hall, and from Sage Hall to Cascadilla Creek. This was then designated as the location of the

—Fenner Studio

Exterior of Olin Hall, housing facilities of the School of Chemical Engineering.

—Photo Science

Exterior of Phillips Hall, recently completed home of the School of Electrical Engineering.



Sketch of new Mechanical Engineering School.

new engineering quadrangle. The preliminary plans called for a group of five main buildings, housing the schools of Chemical, Civil, Mechanical, and Electrical Engineering, and a building providing for materials processing and materials testing laboratories. The first group of the new unit was completed in 1942, when the Olin Hall of Chemical and Metallurgical Engineering, located on the Northwest corner of the new site was occupied by the faculty and students of the school. It was a gift of Franklin W. Olin a graduate of Cornell in the class of 1886. Although he received a degree in civil engineering, Mr. Olin had long been associated with the chemical industry, and his interest in the objectives of Cornell's School of Chemical Engineering prompted him to donate the funds for the erection of the both handsome, and practicable building. The Hall is dedicated to the memory of his son, F. W. Olin Jr., of the class of 1912, who died in 1921.

Prior to the construction of Olin Hall, the chemical engineers had done their research and pilot plant experimentation in a section of Baker Chemistry Laboratory. However, the rise to prominence of the relatively new profession of chemical engineering soon convinced the faculty and administration that new facilities must be obtained. Cornell's School of Chemical Engineering, due to its early start in the young field, and due to its progressive administration had attained a position of national leadership in the education of engineers specialized in the application of the basic sciences to the chemical industry. To maintain this leadership, it was necessary to have complete laboratory facilities for chemical engineering unit processes and operations. The Unit Operations laboratory is a three story unit, occupying an entire wing of the building. At last the Chem. E.'s had a laboratory large enough to build pilot plants which would simulate actual conditions in a full size commercial chemical plant. The unique lab contains various pieces of chemical equipment such as evaporaters, stills, absorption towers, and filter processes. To provide the space necessary for some of the larger towers, one section of the lab is completely free of horizontal divisions. A traveling crane serves this entire section. A parallel area of equal width carries subway gratings on the first and second floor levels to be utilized as operating platforms. A pipe shop, a machine shop, and a wood shop on the basement floor provide facilities for construction and repair of semi-plant scale equipment.

Another unusual feature of the building is the number of smaller labs surrounding the unit operations lab. These are primarily for graduate students engaged in research, and for advanced undergraduates working on their senior projects. Two or three students are located in each small lab, and are usually cooperating on some common research in a specialized field of chemical engineering. The advance undergraduates are assigned labs, given a key to the building, and are allowed to use their designated labs at any reasonable time. Throughout the building are laboratories for small scale foundry practice and crystallography facilities by the metallurgical engineers. Olin Hall also contains several large lecture rooms, an up to date chemical engineering library, a computation room, and offices for the faculty and director of the school. All of the large lecture rooms have no windows, sufficient illumination being provided by artificial light-

ing, and proper ventilation by an automatically controlled air treatment system. Olin was designed not merely to be a large building, but a building with the facilities necessary to provide the particular type of instruction and research developed at Cornell.

After the completion of Olin Hall, the war intervened, and the construction of the new quadrangle was postponed. During this time, funds were being accumulated, and some two hundred donors had pledged a great amount of financial support for the proposed Materials Testing Laboratory. The building was constructed in 1952, at a total cost of $1,700,000. It provides approximately 1.3 million cubic feet of space. The building is actually in two adjoining sections. The eastern portion, named after Dean Emeritus Dexter S. Kimball, long associated with the development of industrial engineering in this country, houses the materials processing laboratories. The other section bears the name of Robert H. Thurston, director of the Sibley College of Mechanical Engineering from 1885 to 1903 and a pioneer in the scientific study of engineering materials.

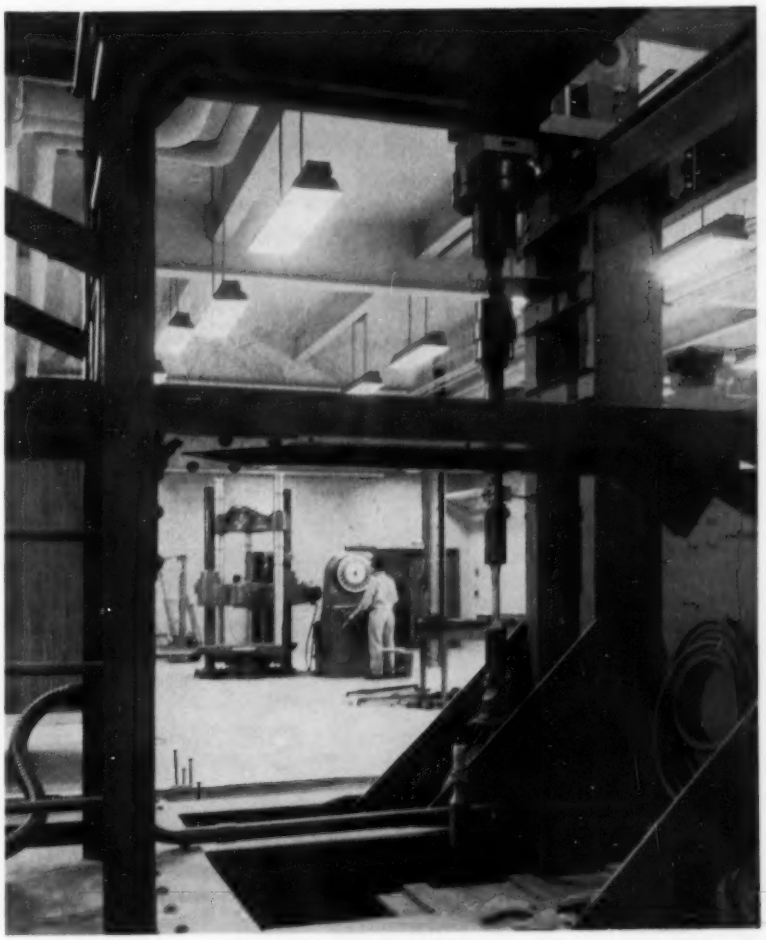
Instead of providing a single large testing machine as is the usual procedure in structures laboratories, Thurston Hall includes a specially designed testing bay sixty feet square and fifty feet high. This portion of the building is designed specifically to withstand the rigorous stresses of both dynamic and static loading which are necessary to test many metallic and concrete specimens. The weighing capsules can be anchored to rock at any location in the bay, making it possible to test assembled bridges, complex structural frames, and other intricately designed specimens in a truly three dimensional test pattern. Standard testing machines of various sizes are also included in other parts of the building. Special features of the building include a complete dynamic photoelastic laboratory, a vibration-free room, a dynamics laboratory, and individual research laboratories for advance graduate research. Kimball Hall for materials processing contains setups for the study of factory layout and planning problems, production techniques, tooling, and methods, as well as motion and time study techniques. Students plan production for a small part and then produce it under conditions similar to industrial operation. According to John F. McManus, Administrative Assistant of the College of Engineering, "Both the engineering materials laboratory and the materials processing laboratory are therefore designed for the dual function of providing basic training for undergraduates, and fostering advanced study and research into new frontiers of engineering knowledge."

Phillips Is Most Recent Addition

The realization of an engineering campus was now within sight, with two buildings completed and in operation, and the plans for a third, Electrical Engineering, nearly completed. Subsequently, Phillips Hall of Electrical Engineering was dedicated on June 11, 1955. Named for Ellis L. Phillips of the Class of 1895, who donated one and two thirds million dollars for the structure, the building is perhaps the best example on campus of a building which is both strikingly handsome, and extremely functional in design. The amount of window space is probably the most noticeable feature of the exterior. The entire front of the building at first glance seems to be constructed of glass panels. Phillips Hall has 94,000 square feet of floor area, and research space is more than double that previously available in the old building. Lecture rooms range from an auditorium seating 228 persons to smaller recitation rooms for 25 or 30 students. A comfortable lounge and a kitchen are also provided. The first floor contains facilities for work in power and machinery; the second floor, offices and network calculator installations; the third floor illumination

Thurston Hall test bay enables full scale test to be conducted by the Department of Engineering Mechanics and Materials.

—Photo Science



studies, basic and industrial electronics, and servomechanisms; and the fourth floor communications and vacuum tube facilities. Generating equipment is in the basement and the roof is specially designed to accommodate antennas and similar apparatus. There is available an acoustics laboratory with sound absorbing walls of unusual design, for testing microphones and sound recording devices. Power distribution within the building is handled by a flexible control board enabling any combination of requirements to be drawn for any room.

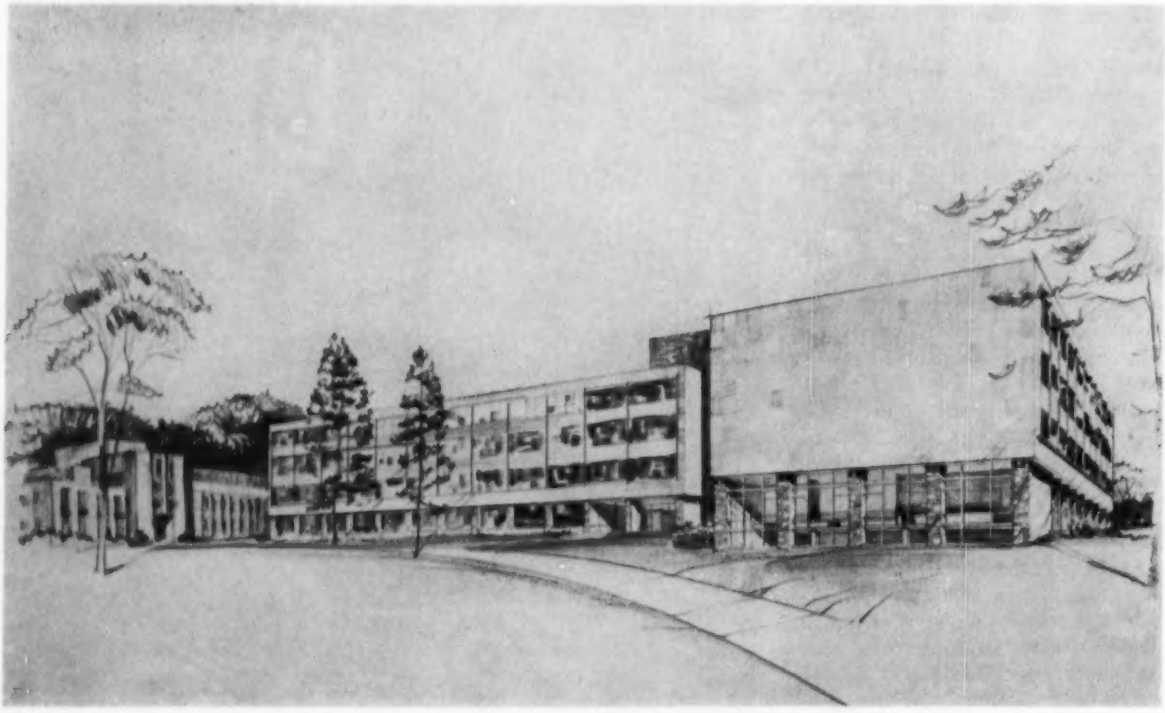
Final Plans Near Completion

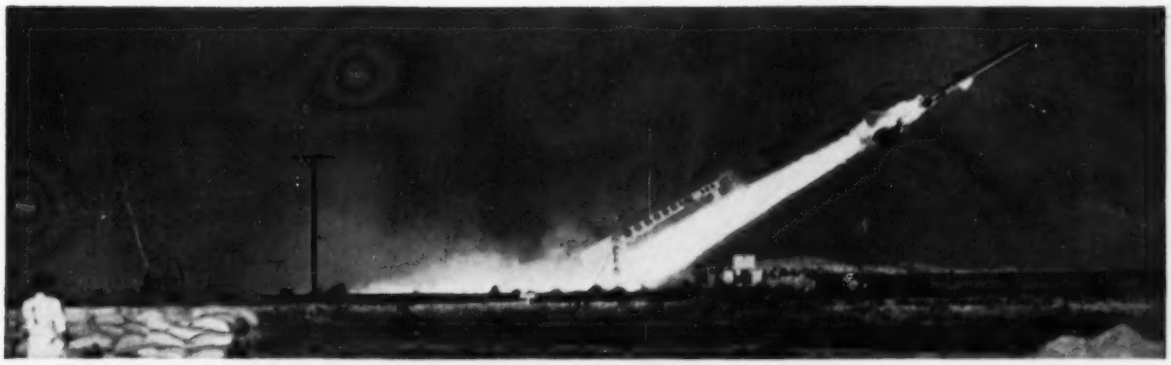
Coincident with the dedication of Phillips Hall was the announcement by the College of Engineering that Walter S. Carpenter of the class of 1910 had donated a sum of money for the new Engineering Library and Administration Building. It is to be the location of the offices of the Engineering College, as well as containing a complete library for the school and additional facilities for graduate research in various departments related to engineering. Construction will begin sometime in the spring of this school year. Plans are also nearing completion for the two remaining structures which have been proposed, the Civil Engineering Building, and the new building for Mechanical Engineering.

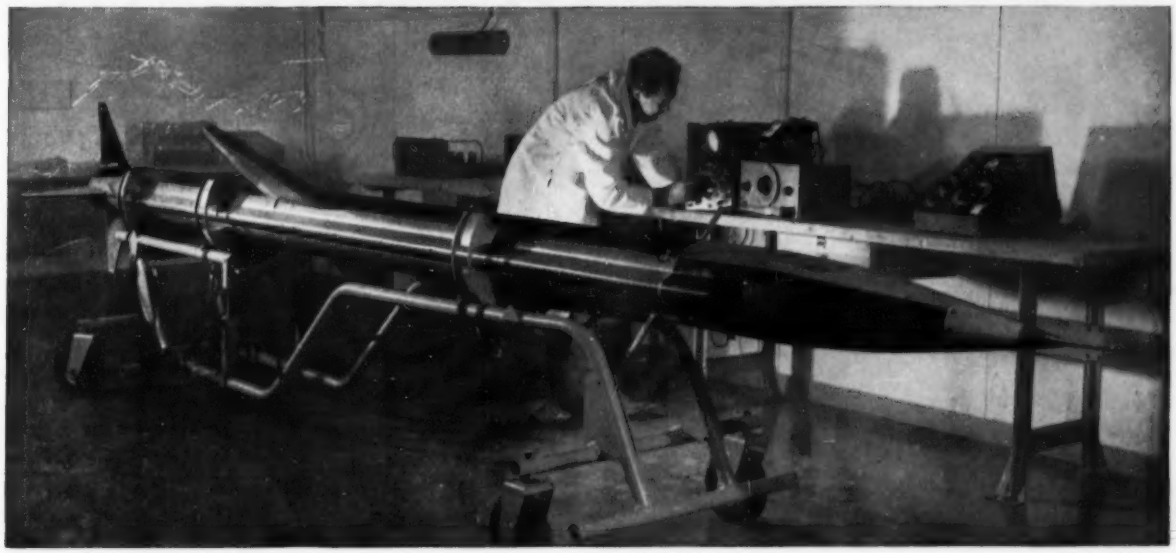
The location of the Civil Engineering Building, will give the CE's an opportunity to survey new territory on the engineering quad. A familiar sight will be lost to the campus when no more engineers can be seen with tripod and tape measure in hand, surveying the well trampled old main quadrangle. The new mechanical engineering edifice will also contain a wing for the Graduate School of Aeronautical Engineering. Plans also provide for an addition to Kimball-Thurston Hall which will house a foundry and other facilities for the metallurgical engineers. The hydraulics laboratory on the edge of Fall Creek Gorge will also be renovated. Due to its location near Triphammer Falls, the hydraulics laboratory is provided with one of the most naturally advantageous sites of any college laboratory of its type in the nation. A good portion of the funds necessary for the completion of the project are now available, and according to Mr. McManus, "we hope to complete all major construction within the next four or five years."

S. C. Hollister, Dean of the College of Engineering, referring to the completion of the entire sixteen million dollar building program, stated: "When this comes about, we shall have the framework for maintaining Cornell engineering in its traditional position of eminence for many years to come." The years to come, however, will produce a great amount of progress in the engineering world. Cornell, with its position of eminence, will not allow this era of progress to pass it by. With the construction of the new engineering campus it has shown that no matter how far engineering technology may progress, Cornell will continue to provide the most advantageous facilities possible to train engineers to meet the greater demands. These facilities, coupled with the progressive and competent staff that the College of Engineering has always maintained, will assure Cornell engineers a training unsurpassed as they take their places in industries and research foundations throughout the world.

Sketch of new Civil Engineering School.







Boeing engineers are insiders on top-secret work

Engineers are doing vital work on significant new developments at Boeing. For example, the Boeing BOMARC IM-99 pilotless interceptor. Its predecessor, the Boeing GAPA, is shown here, because photographs of BOMARC are highly classified. BOMARC is a supersonic long-range missile that spearheads an entirely new weapons system. It is a key weapon in America's defense planning.

BOMARC, as well as other "years ahead" Boeing projects, which cannot be discussed here, are complex challenges to all kinds of engineers. These men find real creative interest in the problems of very high speed flight: heat, compressibility, vibration, rocket, jet and nuclear power, miniaturization, electronic control, and others. Their goal is to design structures and components that will "weigh nothing and take no space," yet withstand extreme velocities and altitudes.

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Engineering

For some years it has been the custom of the CORNELL ENGINEER to devote one issue to a view of the College and the University for the prospective freshmen of the year ahead. I should like, therefore, to address a few remarks on this page to the young people who are hoping to start a career in engineering at Cornell next fall.

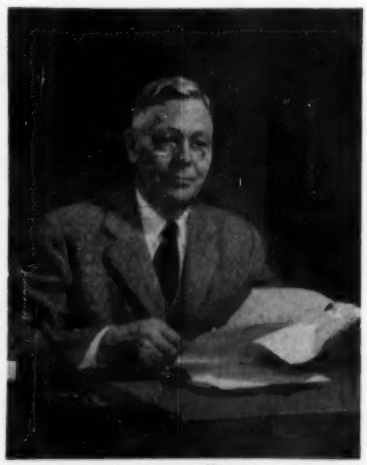
In actual fact, you have been preparing for such a career from the beginning of your school days, but it is at this point that you will be entering the most intensive and most vital stage of your preparation. In these next few years you must develop the knowledge and abilities that will be the basis for forty years or more of professional activity. When you consider the rate at which technology is advancing, you will realize that you—and—we take on a challenging assignment when you come to the campus in September.

Your five years at Cornell are the most important investment you will make for your future. Here are some of the ways in which Cornell Engineering has been planned to give you the most complete experience possible in this period of preparation.

First and foremost, all engineering curricula at Cornell extend over a full five years. Perhaps you have wondered why Cornell should have a five-year program for engineering when most other programs continue on the standard four year basis established many years ago. I could discuss this matter at some length, but ultimately the evaluation of a program must be not in terms of numbers of years but in terms of its objectives and its adequacy in training for the future.

Cornell Engineering reflects the traditional purpose of the College—preparation for professional *leadership*. It is not difficult to see that the responsibilities and opportunities ahead for the young engineer will call for a much more comprehensive technical ability than ever before necessary. The five-year curricula are designed to give this kind of forward-looking background, through:

(a) A thorugh series of courses in the basic sciences and engineering fundamentals, common for all engineers



Dean Hollister

at Cornell . . .

(b) A strong program of theory and application of such fundamentals to engineering design and engineering management
(c) Utilization of the five-year span in order to align courses in a stronger sequence; thus the advanced courses become much more effective when taught after the completion of certain preparatory work rather than simultaneously with such work.

The entire program is intended to be broadly professional rather than narrowly specialized. This does not mean that you will not have an opportunity to follow a particular branch of engineering to a rather advanced stage, but it does mean that throughout the time you are studying your own field of engineering you will be "crossing borders" into adjacent fields, learning and applying the relationships between electrical and mechanical engineering, for example, and others. Modern engineering developments are seldom entirely one kind of engineering or another, but require a complex association of several scientific and engineering fields. Initiation and direction of such developments depend upon the engineer with a breadth of background related to all phases of engineering.

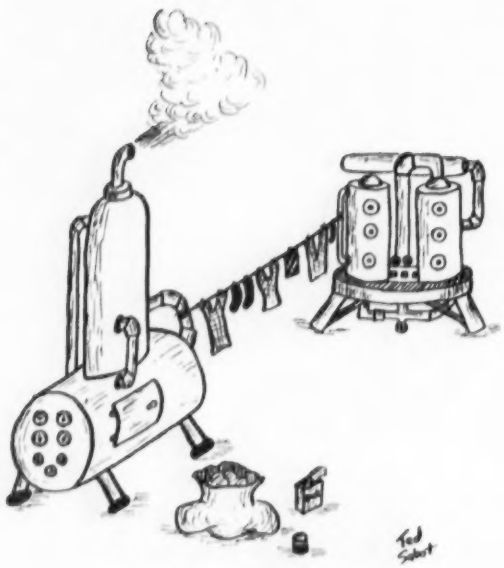
I am confident that you can achieve a high degree of technical competence from this program. There is another aspect of your Cornell experience that is equally significant, however—the development of a personal culture that will have much to do with your professional success, with the part you will play in our complex society, and with your own happiness and satisfaction. Here, too, the engineering curricula have been planned to provide you with a substantial amount of work in general and liberal studies. This is partly prescribed and partly available to you as elective study in the far-reaching fields of the many University departments. We feel that this is a most effective means of broadening your experience and outlook. Rather than grouping all of your non-technical work early in your program—making it something to "get over" before you start your engineering work—we intend that your cultural experience shall develop side by side with your professional growth.

As you progress, you will realize that education is not measured by years, or grades, or degrees, but by an expanding awareness of the great range of human knowledge and the ability to use it constructively. The University atmosphere at Cornell opens vistas of learning that generate a life-long process of education.

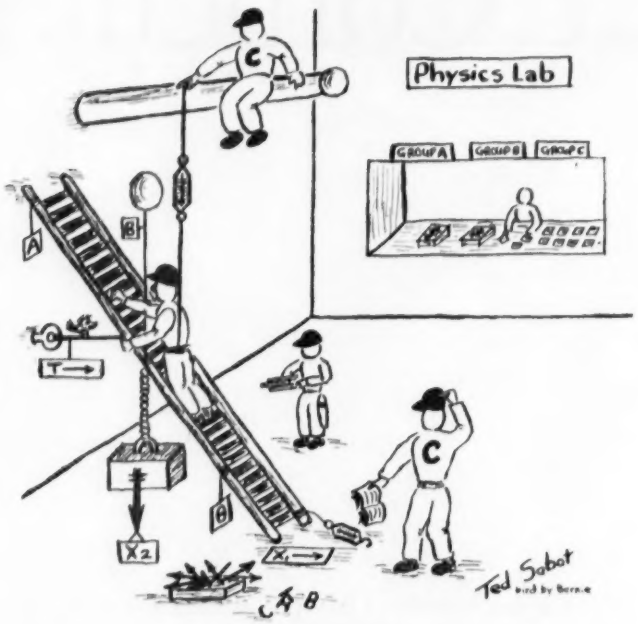
Cornell is an intellectual and an emotional experience, compounded of the excitement of a vast and diverse scholarly community, and the serenity of its natural setting. I hope that for you, as for the generations of Cornell Engineers before you, this will be the stimulus for a distinguished and happy career.

Dean Hollister

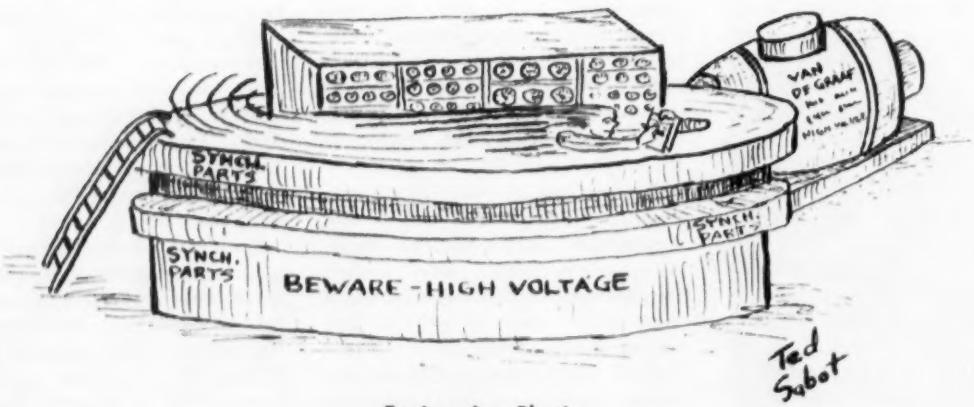
. . . Engineering?



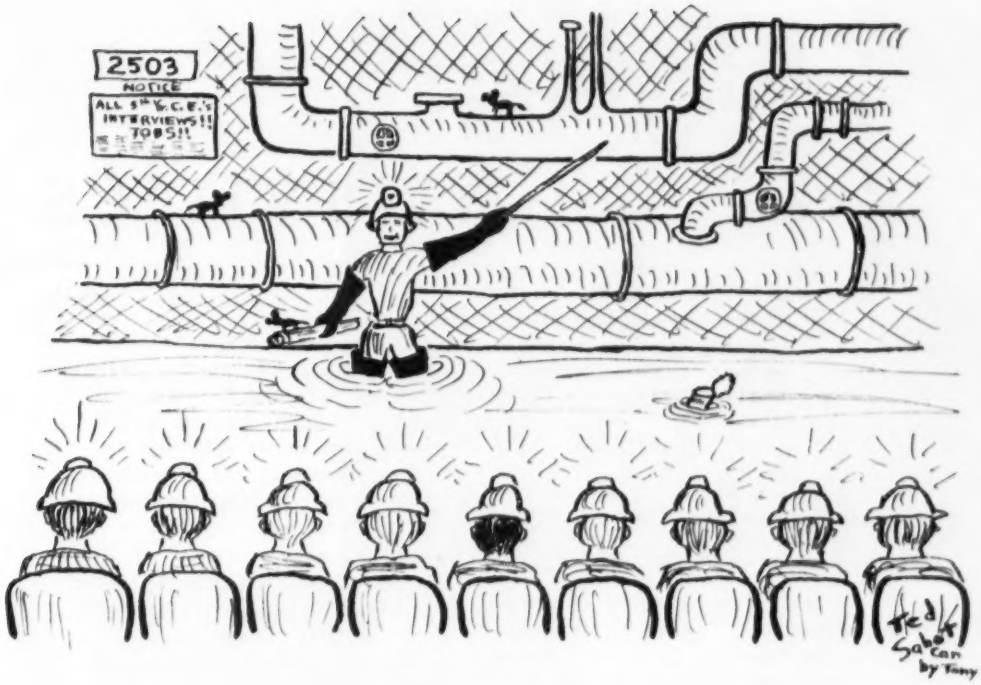
Chemical Engineering



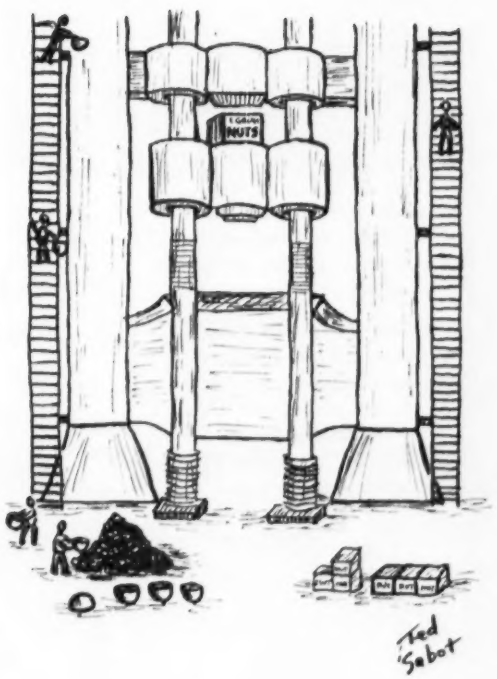
Freshman Physics



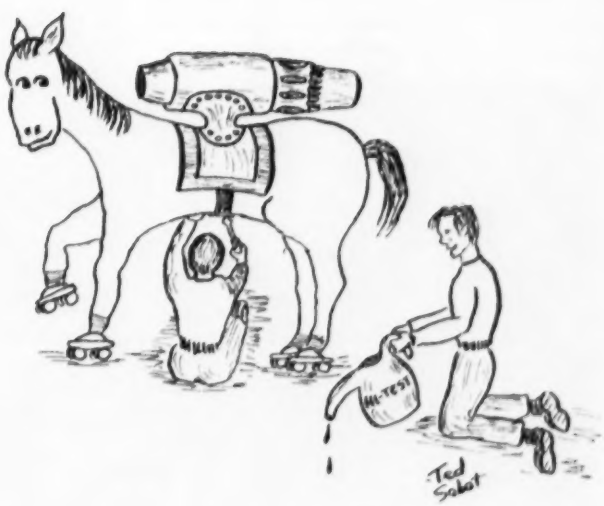
Engineering Physics



Civil Engineering



Mechanical Engineering



Agricultural Engineering

. . . Activities

In many American universities and colleges extracurricular activities have grown to play an important part in education. For a majority of students, the reason for going to college is to be able to find better opportunities after graduation. For this majority, extracurricular activities serve as a means of learning to live in an adult community. Through extracurricular activities an individual can learn the meaning of teamwork and responsibility. Today, many constructive achievements depend upon group cooperation as well as individual leadership. Hence, the practice of responsible teamwork is essential to fulfill the needs of living.

What is the role of an engineering student in extracurricular activities? Some people may think of the engineer as a pure scientist. Actually he is not, but rather he serves as a means of communication between the field of pure science and the outside world. The engineer rarely solves any problem entirely alone but instead must depend upon the cooperation of a group. Therefore, if a student has had experience in working with others in purposeful activities, his abilities and value as an engineer are increased.

Many engineering students eventually intend to enter the field of industrial management or sales. By the mere nature of the requirements for such careers, an individual involved in either field will find that he must consider more than just facts and formulas, but people as well. By starting at college to gain an attitude that encourages teamwork and leadership, a student may develop a valuable tool for future use.

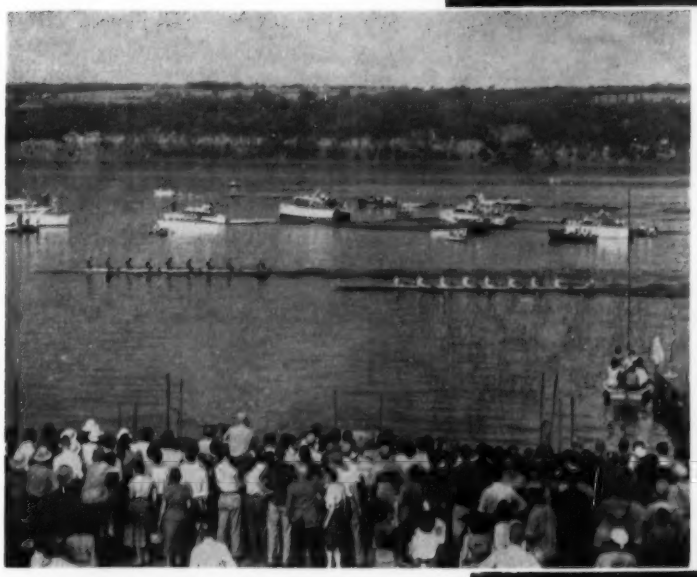
Another advantage gained through working with fellow classmates is the development of a trust in the abilities of others who may be complete strangers. The inability to trust others to do a job as well as you believe you could is perhaps one of the major problems within large organizations, because the lack of such trust tends to set up a mental block against cooperating with others. Participation in extracurricular activities will provide an elementary foundation on which to build a trust in other's ability to perform.

While extracurricular activities are important, don't be misled in thinking that academics are not the more significant part of college life. At Cornell academic achievement is placed above all else. On the other hand, extra-curricular activities do provide the student with additional training with which he may further develop a more mature outlook toward his place in society.

The Cornell Engineer would like to show you, the sub-freshman, a brief summary of what activities are offered to the student at Cornell and also alleviate some of the fears often held by freshmen that college is all work.

The Cornell University Student Council handles many weighty University problems. Included in the work of the "Council" is publicity, campus relations, and planning major week-ends.

—*Stewart*



The Cornell crew races on Cayuga Lake. Crew, one of the five major sports at Cornell, has twenty engineers on the forty member squad. In June 1955 the Cornell crew swept the IRA races at Syracuse.

—*Shuter*

The Cornell Dramatics Club has scheduled six major productions for this year. Their latest production, " Amahl and the Night Visitor," was presented just before Christmas.

—*Shuter*

The Big Red Band is known not only for its music but also for its precision marching. The Big Red Band plays at many campus functions, principally rallies, football and basketball games.
—*Shuter*

Shown is the new swimming pool in Teagle Hall. A recent addition to the University, Teagle Hall houses most of the athletic teams. In addition to the usual athletic facilities Teagle Hall has indoor rowing tanks in order that the crew may practice all year round.
—*Stewart*

The Cornell Daily Sun sometimes known as Ithaca's only morning newspaper provides students with an opportunity to become quite familiar with newspaper operation.
—*Shuter*

. . . and Social Life

Cornell is famous for houseparty weekends. Here a dixieland party is being given on the Libe slope during Spring Weekend 1955. The visiting band is the Spring Street Stompers from Williams College.
—*Shuter*

One of Cornell's most popular customs is the ten o'clock coffee break in the Ivy Room.
—*Stewart*

Every year Cornell sororities compete against each other on Sorority Night. The sororities are judged for originality and talent in the presentation of a skit.
—*Shuter*

Not enough to go around

How times change!

Not so very long ago, an engineer struggled to obtain a degree. Yet afterwards he just couldn't find a job that would let him utilize his hard-earned knowledge, much less start to build a career. Today, however, the demand for engineers exceeds the supply . . . so much so that there are not enough to go around.

We need engineers and skilled technicians. That hundreds of other companies do, too, is extremely well evidenced merely by thumbing through your newspapers and magazines. Why should you choose us above them? Perhaps you shouldn't. Neither should you come to that decision without first becoming fully aware of our record . . . who we are, what we do, where our future lies. For, in whatever field you choose to pursue a career, your transition from neophyte to veteran will not depend on ability alone. Without ample opportunities to demonstrate your talents, you'll not be able to prove your potential value in any industry.

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William M. Leonard

"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates, and former students and to establish closer relationship between the college and the alumni."

TO THE SUB-FRESHMAN:

Before you make that big decision to attend the Cornell Engineering School, you owe it to yourself to review carefully all the reasons why you should not study to become an engineer.

To begin with, the chances are overwhelming that by your five years at Cornell you are not going to engineer yourself into the big money, the heavy purse. So, if it is pink convertibles, plush motor cruisers or private airplanes that your little heart desires, get yourself into some other business but fast. In fact, you'll be saving time as well as sparing yourself disappointment because a college education is a distinct disadvantage in most of the fields that bring in the real dough. Ask yourself—how much good would a diploma do for Jackie Gleason or Rocky Marciano, for instance?

Nor is engineering going to bring you any fame—local, national or international. How many people do you think would know of Ben Hogan today if, when he was your age, somebody took away his driver and gave him a slide-rule? People still talk about Sandow, the strong man, even though his fame first blazed at the Columbian Exposition of 1892. I defy you to name just one engineer of the Class of '92 and I'll let you pick any college. And do you think an appreciation and understanding of the Calculus will ever make your name a household word, if that's what it is, like that of Papa Dionne?

Perhaps your ambitions do not run to cash and fame. Maybe you'd be content in the relative anonymity of luxurious working surroundings—plush carpets and carved oak panelling, complete with beautiful secretary. What a contrast with the usual engineer's surroundings! High drafting table, piled with blueprints, ash trays, T-squares and scratch pads, in company with two hundred other drafting tables, identical in their ordered confusion except for the profile of the face beneath the eyeshade.

I'll admit there are exceptions to the rule. Herbert Hoover, for one, did well enough financially in his engineering days so that he has been able to serve his countrymen without fee for the past quarter of a century. And enduring fame has been the reward of General George Goethals who built the Panama Canal and what's-his-name who designed Galloping Gertie at Tacoma. And, we will admit, some of today's successful engineers spend their working hours in deluxe surroundings, their luxury only marred by the static electricity they pick up from the Oriental and the fact that their desk cigar-lighter doesn't work.

But, your chances of such emoluments are so slim that you'd be foolish to hope to achieve them for yourself through five years of nose-to-the-book at Cornell. You would do better, so far as mathematical chances are concerned, to buy yourself a Sweepstakes ticket. So, I suggest that, if pelf and name you want, set off for Hollywood, Stillman's gym, sit on top of a flagpole or marry an heiress.

So, forget about signing up at Cornell, unless you are one of the rara avis who wants above all to be useful, doesn't mind long hours or moderate pay so long as you can create or contribute and who rejoices in team accomplishment. This would make you one of the stubborn, conscientious men who think it a privilege, even a duty, to join the ranks of the professional people the world cannot do without and to whom it is in constant, if unmentioned, debt . . . the engineers who design and improve the world we live in today and the one our children must live in tomorrow—the engineers, general and specialized, on whom the pre-eminence and very existence of our Nation depends.

If that's the kind of man you are, time's awasting! Jump on your horse and come to Ithaca. Cornell, your country and your countrymen need **you** and every young American like you!

William M. Leonard, *President*

ALUMNI ENGINEERS

Jack H. McMinn, B.S. in C.E. '44, 45 Murray Avenue, Larkspur, Cal., has opened an engineering consulting office in San Francisco, Soil Testing Services of California, Inc. The new corporation is associated with Soil Testing Services, Inc., Chicago, Ill., of which **John P. Gnaedinger, M.C.E. '47** is president.

Albert J. Maiorano, B.C.E. '48, is a project engineer with Poirier & McLane Corp., New York City. His address is 29 Thomas Avenue, Batavia.

Ralph R. Hennig, M.Chem.E. '53, is a research chemical engineer and lives at 311 East Eighty-sixth Street, New York City 28.

Thomas H. Porter, '49, moved to Detroit in May to become a gas turbine design engineer for Ford. He had been with Boeing in Seattle, Wash., since graduation. He lives at 14-304 Riverview, Detroit 35, Mich., with his wife, a son, and daughter.

Arthur Messiter '52 has been awarded a Howard Hughes Fellowship for 1955-56, and will study at California Institute of Technology while remaining with Hughes Aircraft in Culver City, Cal.

The Lincoln Arc Welding Foundation recently awarded a $250 second prize in the structural division of its annual award program to **Mario D'Aguino '54** for an essay entitled "A Welded Rigid Frame Foot Bridge." Requests for copies may be mailed to the organization's headquarters at Cleveland 17, Ohio.

Daniel D. Huyett, M.E. '12, retired in March, 1954, after thirty-four years with Atlas Powder Co., Wilmington, Del., where he was head of mechanical process development engineering in the research and development section of the explosives department. He holds many patents relating to the mechanization of explosive assemblies. Huyett is married and has two sons and four grandsons. His address is 2100 Woodlawn Avenue.

Pictured above are seven of the eight alumni of Cornell University who are now employed at Hamilton Standard, division of United Aircraft Corporation, Windsor Locks, Conn. They are left to right, front row: John C. Sterling, Jr., '41, senior project engineer; Melvyn E. Longfellow, '29, designer; Thomas J. McGuff, '50, senior test engineer, and Bill A. Selling, '49, senior test engineer.

Back row: Harold L. VanAlstyne, '26, designer; William H. Habicht, '40, senior project engineer, and Harry M. St. John, Jr., '42, systems engineer.

John W. Powers, '44, assistant project engineer, was not present for the picture.

ANNOUNCEMENT

Late last year, the Cornell Society of Engineers published a directory of the members of the Society, and included in that volume a geographic list of all alumni of the engineering colleges.

The directory was distributed to the members of the Society. It is now made available to all Cornellians. A check for $3.00 sent to Cornell Society of Engineers, 107 East 48th Street, New York 17, New York, with your name, address and class will secure for you a copy of this first directory of Cornell engineers.

(Continued on page 48)

College News

New Plant for CAL Air-supported Radome

A new company has been formed for the research and manufacture of "structures supported by air" by the men who developed the air-supported radome at Cornell Aeronautical Laboratory, Inc. The company, Birdair Structures, Inc., will be located at 290 Larkin St., Buffalo.

Walter W. Bird, a principal engineer on air-supported structures at Cornell, is president and treasurer of the new organization. He and a number of his associates will split away from the Laboratory early next year in an effort to find commercial applications of techniques learned in the nine-year development of the air-supported radome at Cornell Laboratory.

Early production of the structures by Birdair will be largely for the government. The cover type products are made of coated synthetic fabrics and are noted primarily for their strength, versatility and portability. The structures require such low air pressure that inexpensive commercial blowers can be used to simultaneously ventilate and support them.

Joining Bird, who lives in Williamsville, in the venture are: Alvin C. Smith of East Aurora, Industrial Development and Sales; John D. Masters, Business Manager; George F. Reitmeier, Jr., Chief Engineer; and Anson T. Baschmann, Production Supervisor. All are employees of Cornell Laboratory. Bird, Smith and Masters make up the Board of Directors. An attorney, Robert Fernbach, is corporate secretary.

The mushroom-shaped air supported radome has become familiar in recent years as housing for the nation's radar-warning equipment in locations from the Arctic to the Tropics. Air-supported radomes can withstand winds of over 125 miles per hour and temperatures from 65 degrees below zero to 140 degrees above.

Although designed for military purposes, the new building concept offers structural and architectural features that open new vistas in the design of portable or semi-permanent buildings.

Air-supported structures have been suggested for a variety of commercial uses, ranging from a portable enclosure for a carnival or sports arena to a bulk storage center for grain. They are particularly advantageous when large floor areas unobstructed by steel beams are desired. Cost savings are high in their construction since no heavy steel trusses, normally used to support a roof, are needed. Rough cost estimates on a 110-by 225-foot athletic building with an air-supported roof were less than half of the estimated cost for a smaller conventional building.

Bird said the company already had a number of commitments for work and that many additional inquiries had been received. He said that since the company will specialize in the research and manufacture of light-weight, portable structures of all types, proposed applications would be welcome.

—Appalachian Electric Power Com.

Debris scraped from the racks on the intake pipe and heaped near by.

River Flow Project

The complicated flow patterns of river debris were investigated in miniature in the Civil Engineering hydraulics laboratory this fall. Professor Marvin Bogema, of the Department of Hydraulics and Hydraulics Engineering, designed a scaled plaster model of a two mile curve of a West Virginia river for the study.

Interest in the project was triggered by a storm on March 7, 1955 that washed debris into the Kanawha River. As the water swirled by the Kanawha River Plant near Glasgow, W. Va., waterlogged sticks, logs, tires and tin cans were swept into the intake structure. The intake was completely plugged and only continous dredging could keep it clear.

The American Gas and Electric Service Corporation, which does the design work for the power plant, planned a protective device for the condenser intake. The company proposed a sheet piling diverter to be placed in front of the intake and to run parallel to the shore about 75 feet out into the river. It asked Professor Bogema, with the assistance of Leo Hovi, one of their junior engineers, to test and modify the structure.

Since scaled models can predict to a fair degree of accuracy the behavior of full size hydraulic structures, Professor Bogema constructed a model of a two mile section

(Continued on page 36)

RCA TV camera encased in special diving bell televises the activities of sea life in sunlit waters off the Gulf Stream.

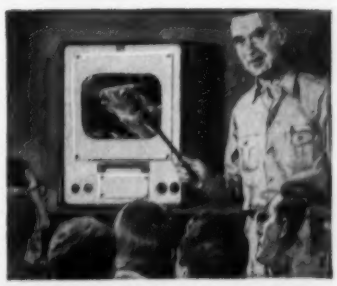
Now RCA puts TV underwater to help the Government protect marine life

Ten fathoms down, an RCA television camera moves through darting schools of fish. On the surface, U.S. Fish and Wildlife experts hover over an RCA remote control TV monitor. From what they see will come new fishing techniques to help the government protect marine life.

The electronic and engineering skill behind underwater TV is inherent in all RCA products and services. And continually, RCA scientists at the David Sarnoff Research Center in Princeton, N. J., delve into new "Electronics for Living" that will make life fuller, easier, happier.

WHERE TO, MR. ENGINEER?

RCA offers careers in research, development, design, and manufacturing for engineers with Bachelor or advanced degrees in E.E., M.E. or Physics. For full information, write to: Mr. Robert Haklisch, Manager, College Relations, Radio Corporation of America, Camden 2, N. J.



U.S. Fish and Wildlife Service technicians study fishing methods and equipment of an RCA remote control TV monitor.

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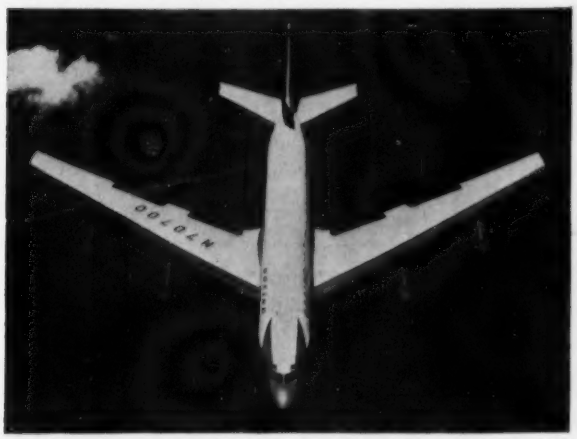
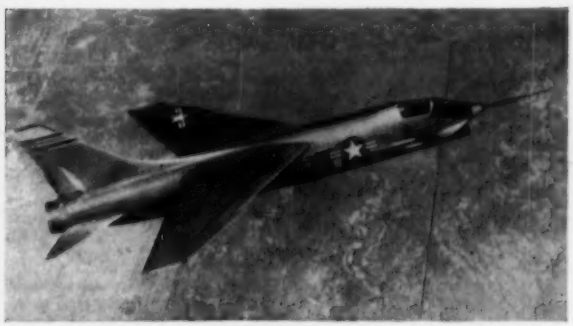
McDONNELL F-101 — The Voodoo, an Air Force supersonic fighter that has two J-57 engines with afterburners, is the most powerful jet fighter yet built.



BOEING 707 — The Stratoliner will usher in commercial travel in the jet age. It is the counterpart of the KC-135, a military tanker-transport powered by four J-57 engines.

BOEING B-52 — Eight J-57 engines, mounted in pairs, power this all-jet, heavy Air Force bomber.



CHANCE VOUGHT F8U — Powered by a J-57 with afterburner, the Crusader is the Navy's fastest carrier-based fighter.

The best airplanes... are designed around the best engines

Today's most valuable military aircraft, capable of supersonic or intercontinental flight, include various Air Force and Navy fighters, bombers and transports. Among these are nine types that have a significant feature in common. They all fly on one type of engine — the J-57 turbojet.

Also entrusted to the efficient, dependable operation of Pratt & Whitney Aircraft's jet engines will be the commercial jet transports soon to travel along the air lanes of the world.

The excellence of the J-57 is attributed to the engineering team that has determinedly maintained its leadership in the field of aircraft powerplants. Effort is now being directed toward the improvement of advanced jet and turboprop designs. Still to be anticipated is mastery of current technology's most provocative problem — the successful development of a nuclear aircraft engine.

Many engineering graduates would like to be concerned with the air power of the next generation. One way to fulfill that ambition is to pursue a career alongside the Pratt & Whitney Aircraft engineers who have consistently produced the world's best aircraft engines.

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College News

(Continued from page 32)

of the river, complete with condenser water intake and deflector wall. Using government surveys of the river bottom, the professor shaped the contours to scale one foot to 1000 feet horizontally, and one foot to 200 feet vertically. The model extended eleven feet with water depth ranging from two to three inches. Water was kept circulating by two small pumps. One maintained the river flow and the other drew in water at the intake structure and released it at the adjacent discharge outlet. One tenth gallon per minute represented 600 cubic feet per second.

Tests were conducted at four river conditions—flood, high, average and low. Reenacting the damaging flood required up to twenty gallons per minute, equal to a torrent of 125,000 cubic feet per second. After several trials, Professor Bogema discovered that cabbage seeds acted similar to the harassing waterlogged debris and small spheres of resin behaved like suspended river matter. Surface litter, while not the problem under study, was represented by confetti. Since the plant is designed to allow for future expansion from the present two units to five units, the intake-outlet circulation pump operated at varying capacities.

The hydraulic characteristics of eight modified structures were studied. Each minature jetty was composed of sheet and tubular aluminum. Professor Bogema was able to reduce the amount of bottom trash that went into the inlet from 98% without any protective jetty, down to 3-4%. When the tested deflector will be installed in full scale at the plant, the walls will range in height from thirty to forty feet and be 300 feet long. Cells fifteen feet in diameter will support the structure.

The most striking result of the model study was the way it clearly demonstrated the movement of bottom carried debris. Observers at the plant noticed that the surface debris moved to the outside of the bend in the river even though the plant was situated on the inside of the bend. When the model was run, it was shown that the action of spiraling secondary currents swept the bottom debris to the inside of the bend, hugging the shore and therefore passing directly in front of the plant intake, while the light debris was carried to the outside of the curve. Only the debris in suspension moved downstream parallel to the banks.

Presents Paper on Brake Energy Dissipation

Assistant Prof. Robert L. Wehe of the Department of Machine Design in the Sibley School of Mechanical Engineering at Cornell presented a paper, "Brake Rating for Automotive Vehicles," at the annual meeting of the Society of Automotive Engineers in Detroit (January 9-13).

The paper is the result of a two-year research study of automotive brakes. The problem was to establish better standards for brakes to promote safer driving.

In stopping a passenger car or truck on the highway, a large amount of energy must be absorbed, and the heat generated must be rapidly dissipated to prevent burning out the brake linings. The paper contains a theoretical analysis of the problem, plus some suggestions for establishing standards that will improve brake design and performance.

"Bumblebee" Discussion Panel At Buffalo

The Aerodynamics Panel of Project Bumblebee, an across-the-board missle research and development program, met for two days, Jan. 4-5, at Cornell Aeronautical Laboratory, Inc.

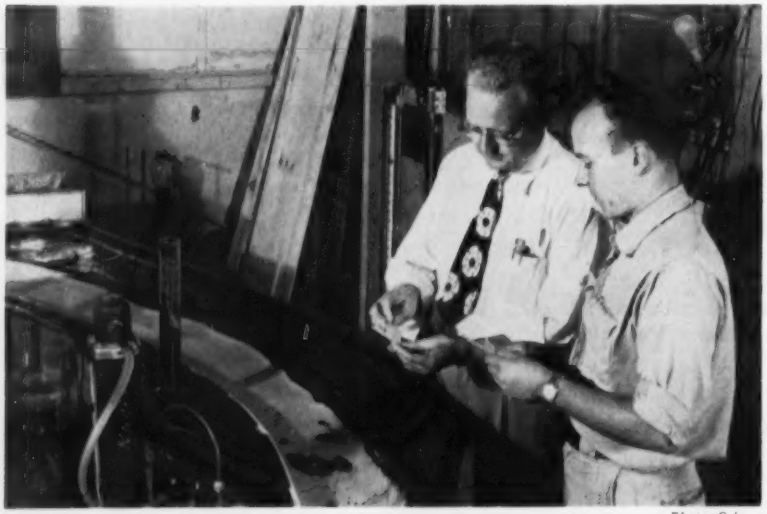
More than 100 engineers, scientists and others from the aircraft industry and the armed services attended the classified sessions. Thirteen technical papers were read and discussed and the Laboratory was toured. George E. Bartlett of the C.A.L. Aerodynamics Research Department, was in charge of arrangements.

The Bumblebee program has been in existence for more than a decade and has resulted in several missiles, including the recently-announced Terrier missile. The Laboratory, part of Cornell University, is engaged in at least two guided missile research programs.

American Statistical Association Meeting

Three members of the Department of Industrial and Engineering Administration of the Sibley School of Mechanical Engineering at Cornell took part in the 115th Annual Meeting of the American Statistical Association in New York City the week of December 27.

Professor John H. K. Kao presented a paper, "The Weibull Distribution in Life-Testing of Electron Tubes," before the Section on Physical and Engineering Sciences. Professor Robert E. Bechhofer presented a paper, "A Three Decision Problem Concerning the Mean of a Normal Distribution," for the same section. Professor Andrew Schultz, Jr., discussed several papers relating to Industrial Operations Research.



—Photo Science

Professor Bogema (left) and Leo Hovi (right) work on scale model of Kanawha River.

A Campus-to-Career Case History

Dick Abraham of Bell Telephone Laboratories, here experimenting with closing the loop on a transistor feedback amplifier.

"I'm working with top names and top talent"

That's one of Richard P. Abraham's comments about his career with Bell Telephone Laboratories in Murray Hill, N. J. "In 1954, after I'd received my M.S. from Stanford," Dick continues, "I was interviewed by a number of companies. Of these I liked the Bell Labs interview best—the interviewer knew what he was talking about, and the Labs seemed a high-caliber place.

"The Labs have a professional atmosphere, and I'm really impressed by my working associates. As for my work, I've been on rotating assignments—working with transistor networks and their measurement techniques, studying magnetic drum circuitry, and doing classified work on Nike. This experience is tremendous.

"In addition to the job, I attend Lab-conducted classes on a graduate level several times a week. Besides that, the Labs are helping me get a Ph.D. at Columbia by giving me time off to get to late afternoon classes. That's the kind of co-operation you really appreciate from your company.

"What are important to me are the opportunities offered by the job and the work itself. My wife and I own a house near Murray Hill, and we've found a lot of friends through the Labs. All in all, I think I'm in the right kind of place."

Dick Abraham is typical of the many young men who are finding their careers in the Bell System. Similar career opportunities exist in the Bell Telephone Companies, Western Electric and Sandia Corporation. Your placement officer has more information about these companies.

Bell Telephone System

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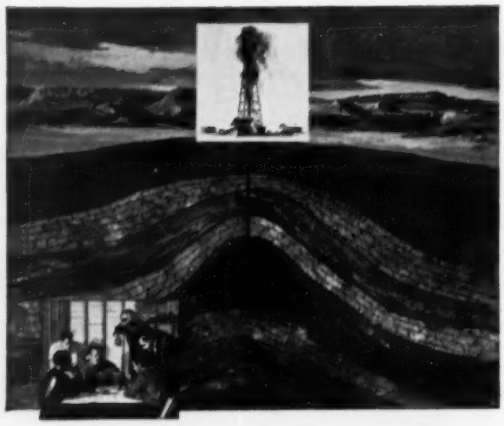

Crude oil spouting from the earth is the fabulous fountain that has put this nation on wheels and wings. Oil has made millions of homes and buildings more comfortable and, through the "magic" of petro-chemistry, hundreds of new products have been created, ranging from fabrics to formaldehyde.

Modern, advanced refining methods are producing the most powerful gasolines ever offered, to fuel America's 67 million cars. The airlines' planes and the railroads' diesels depend on the same petroleum for their tremendous power.

The rocketing importance of oil to so many major segments of the nation's economy makes finding new reserves to be tapped an unending, expensive job. And it is to the industry's credit that it is reinvesting—year after year—so much of its own money in exploration, research and expansion—determined to be ready to meet a market for petroleum fuels that is expected to climb to an awesome $32 billion annually by 1975.

The petroleum industry always has depended on steam for power, heating and processing. And steam's versatility was most recently demonstrated when several major refineries contracted with B&W to build special Carbon Monoxide boilers to convert waste gases into useful power. B&W, working cooperatively with the oil companies, is providing efficient, economical steam throughout the petroleum industry—as it does throughout *all* U. S. industry. The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.

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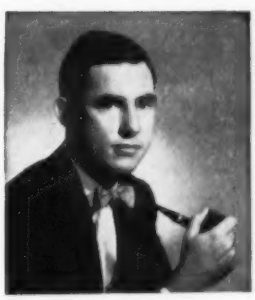
George Lincoln asks:

What do metallurgists do in a chemical company?

GEORGE M. LINCOLN, JR. expects to receive his B.S. in metallurgical engineering from Lehigh University in 1957. George is active in sports, vice president of his junior class, and a participant in many other campus activities. He's starting his employment investigations early, for he feels that the selection of an employer is one of the most important decisions in a man's career.



CHARLES I. SMITH, JR. received his B.S. Ch.E. from V.P.I. in 1943, served in the Navy as an engineer officer, and joined Du Pont's Engineering Department in 1946. Since then he has advanced steadily through a number of interesting assignments at various Du Pont plants. Today Charlie Smith is technical superintendent of Du Pont's Newport, Delaware, Plant, Pigments Department.

Charlie Smith answers:

They have an almost endless variety of interesting problems to face, George. As a student of metallurgy you know that about two-thirds of all known chemical elements are metals. Many of them are revealing valuable new applications, when highly purified on a commercial scale. Du Pont is greatly interested in several metallic and semi-metallic elements.

My own experience at Du Pont ranges from work on titanium pigments, to metallic titanium production, and to the ultra-pure silicon used in transistors. You can appreciate some of our metallurgical problems when I point out that impurities in transistor silicon have to be below one part in 100 million. That's equivalent to one pound of impurities distributed through a train of ore cars twenty miles long!

Some of our metallurgists carry out fundamental research on new metals, and, in the development stage, they frequently operate pilot plants for producing them. Other metallurgists study problems relating to engineering materials used in construction, carry out research on intergranular corrosion, or investigate fatigue relationships encountered in dynamic, high-pressure operations.

You'll find many challenging opportunities in every phase of metallurgy at Du Pont, George.

Metallurgists and Metallurgical Engineers can find some of Charlie Smith's challenging new problems described in "Engineers at Du Pont." For a free copy of this booklet write to E. I. du Pont de Nemours & Co. (Inc.), 2521 Nemours Building, Wilmington 98, Delaware.

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BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

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Technibriefs

Development of Solid Atomic Fuels

Virtually all nuclear reactors will use solid fuel elements, rather than liquid fuels. Dr. Bernard Kopelman, chief engineer of the Atomic Energy Division, Sylvania Electric Products Inc., believes that solid fuels will be used in reactors because of their relatively advanced state of development.

Development efforts in solid fuels, according to Dr. Kopelman, will be directed towards long-life fuel elements that are relatively easy to fabricate and reprocess. Great strides can be made in this direction by proper coordination of reactor physicists, metallurgists, nuclear engineers, and chemical processors.

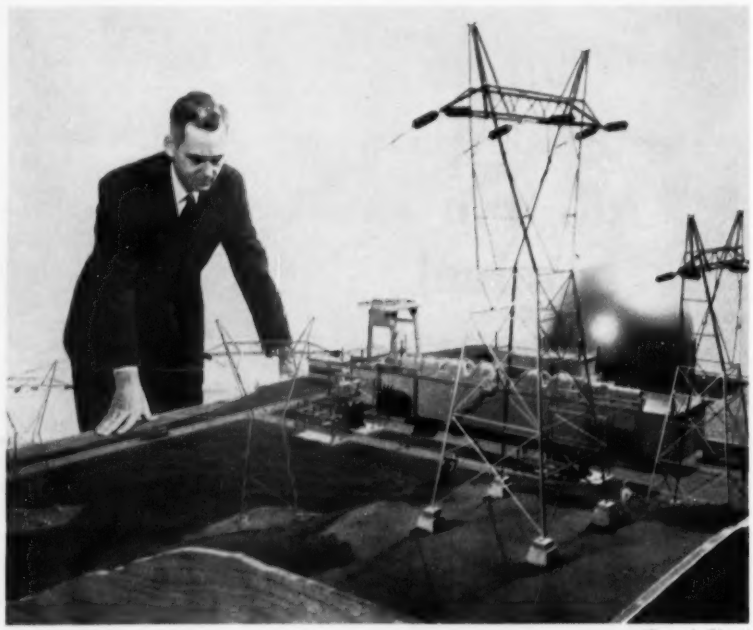
Corrosion will remain the principal obstacle to fluid fuel reactors, he said. If this can be overcome at reasonable cost, then the fluid fuel will be able to make a place for itself in the reactor business.

Among other problems presented by fluid fuels, Dr. Kopelman cited the need for high-pressure operation in some instances; "mass transfer", resulting in plugging of heat exchanger coils; the need for maintaining an extremely leak-proof system to prevent escape of dangerous radioactive material; and high construction and maintenance costs resulting from these considerations.

A solid-fuel reactor has, by comparison, certain advantages because there are no moving parts associated with the radioactive fuel, and, because it is contained within a much smaller volume, maintenance and therefore the percent of shutdown time is greatly reduced. This is an important consideration in the development of competitive power, and may well be the determing factor responsible for the emergence of one of these two reactor types into general prominence.

Dr. Kopelman said that it was obvious that special requirements will be associated with each potential reactor use, and these requirements will influence markedly the type of reactor and fuel element selected. It would seem unlikely that one particular type of reactor or type of fuel would prove best under this wide variety of situations.

Kopelman feels that in common with many industrial products, one can expect several types of reactor, fuel will prove to be competitive, and others may serve to complement the field.



—General Electric

The General Electric Company model of future nuclear plant for the production of electric power went on display recently in the Department of Commerce Building, Washington, D. C., as part of a general atomic energy exhibit. Examining the model is Mr. F. K. McCune, vice-president and general manager of G. E.'s Atomic Products Division. McCune recently stated that "possibly within five years, certainly within ten" economic electric power could be produced in atomic plants.

New Mining Technique Used By International Nickel

Also of current interest is an engineering project unusual in open pit mining. The International Nickel Company of Canada, Limited, is driving two vehicular tunnels with a total length of 2,200 feet in the walls of its Frood-Stobie Open Pit in the Sudbury District of Ontario to permit greater recovery of ore by low-cost surface methods.

This project will consist of tunnels that will take the place of sections of the main ramp road which winds for almost two miles around the sides of the Open Pit, now nearly 600 feet deep. When the tunnels are completed, pit traffic will be routed through them, and the affected portions of the ramp road will disappear as the ore over which they lie is mined. The usual surface mining procedure of churn-drilling, blasting and trucking will be used to recover the ore beneath the ramp.

The ore is comprised of a large block in the football, as the wall on the underside of a vein or ore structure is known, and a smaller block on the hangingwall, or upper side. A total of 5,000,000 tons of ore is involved.

Originally it was planned to recover the ore by underground

(Continued on page 44)

GRUMMAN ENGINEERS LAND NEW JET FIGHTER

The Grumman test-pilot engineer at the controls of this new Grumman jet is being directed by another engineer acting as a Landing Signal Officer. The engineer LSO signals the pilot for proper cut height and position to land in front of the grid camera. The purpose is to check main landing gear instrumentation-main gear axial, side and drag loads. This is one of the many checks made before the fighter is sent to the Navy for demonstration of its carrier suitability qualifications.

To learn more about the interesting role of engineers at Grumman, write for the booklet *Engineering for Production.*

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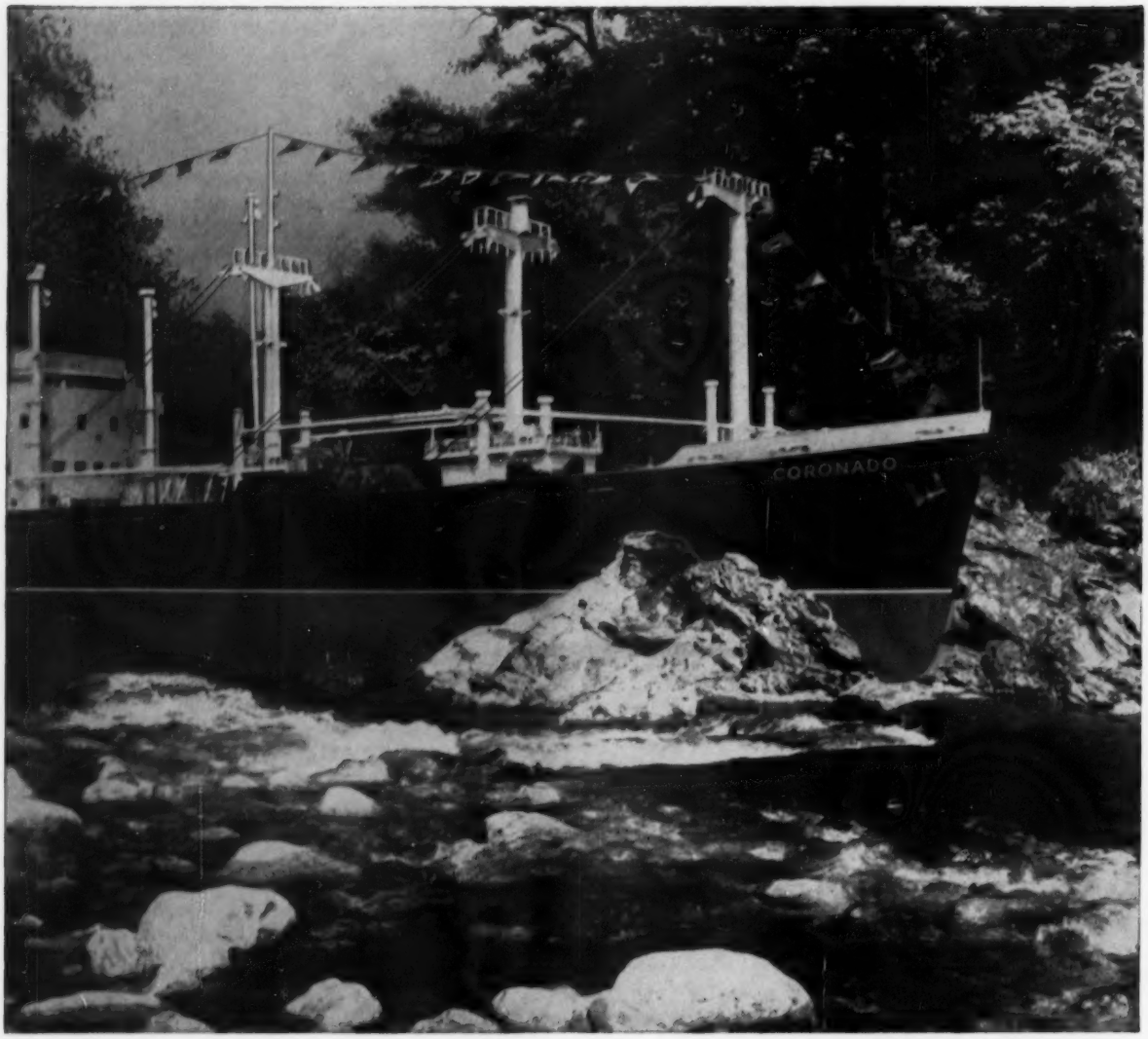

You can't launch an ocean liner in a mountain stream

Initiative alone is not the answer to a man's career. A man can't travel far in narrow, limited confines. Neither can he expand in an unprogressive, stagnant organization. A man needs opportunity to put his ideas into action. He needs to be able to move ahead without waiting for vacancies to occur from death or retirement.

Columbia-Southern is one of the fastest growing companies in the fast-growing chemical industry. It is progressive, alert, and on the move.

Opportunities exist with Columbia-Southern in engineering, research and development, sales, plant design, mining, construction, maintenance, production, accounting, transportation and related fields.

Columbia-Southern encourages its employees to grow professionally and the management believes in placing men in positions of greater responsibilitity as soon as they are ready for it.

Columbia-Southern is going places and it needs good men. If you would like to be a part of this organization, write today for further information to Department P at our Pittsburgh address or any of the plants.

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IN CANADA: Standard Chemical Limited and its Commercial Chemicals Division

Carl Vrooman, icing tunnel group head, studies hot-air cyclic de-icing test on wing section of C-130 transport. The tunnel has a temperature range of −40° F. to +150° F. and maximum air speed of more than 270 mph.

Icing tunnel speeds thermodynamics research at Lockheed

Designed to meet a constantly increasing volume of thermodynamics work, Lockheed's icing research tunnel provides year 'round testing in meteorological environments normally found only in flight. It is the first icing research tunnel in private industry.

Lockheed thermodynamics scientists were formerly limited to testing time available at installations such as Mt. Washington. Now they are able to study in greater detail problems such as: thermal anti-icing; cyclic de-icing; various methods of ice removal; distribution of ice; rate of temperature changes in aircraft components; thermodynamic correlation between laboratory and flight testing; and development and calibration of special instrumentation.

B. L. Messinger, department head, analyzes test results with Thermodynamics Engineer E. F. Versaw and Thermodynamicist Tom Sedgwick. The report was in their hands *only two days* after it was decided to conduct the test.

LOCKHEED

AIRCRAFT CORPORATION

California Division

BURBANK

CALIFORNIA

C. H. Fish, design engineer assigned to the tunnel, measures impingement limits of ice on C-130 wing section. The tunnel has refrigeration capacity of 100 tons, provides icing conditions of 0 to 4 grams per cubic meter, droplet sizes from 5 to 1000 microns.

Thermodynamics career opportunities

Increasing development work on nuclear energy, turbo-compound, turbo-prop and jet transports, radar search planes and supersonic aircraft has created a number of positions for Thermodynamics Engineers and Thermodynamicists.

You are invited to contact your Placement Officer for a brochure describing life and work at Lockheed in the San Fernando Valley.

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with DENISON hydraulic equipment

FAR BELOW THE EARTH is a tremendous reserve of crude oil. The problem is how to find it. Denison helps the cause by speeding the operation of shot-hole rigs.

These rigs drill holes into which charges are dropped. A seismograph records shock waves from the explosions and helps geophysicists determine where the oil is. With Denison Pump/Motors furnishing power for raising the mast and for drill pull-down, one company drills 33 holes —70-feet deep—in eight hours.

Denison Pump/Motor used on drilling rig

Denison pumps, motors and controls supply dependable power for countless industrial applications. For information about applications and the design of Denison oil-hydraulic equipment, write to—

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Leading Designer and Manufacturer of Hydraulic Presses and Components

DENISON hydr OIL ics

Technibrief

(Continued from page 40)

methods after all surface mining had been completed and the road was no longer required. The ore would then have been mined by the same methods as are being used in the south end of the Frood section of the pit, and also in the Stobie section, where surface operations have been replaced by blast-hole mining carried on from the 600-foot level underground.

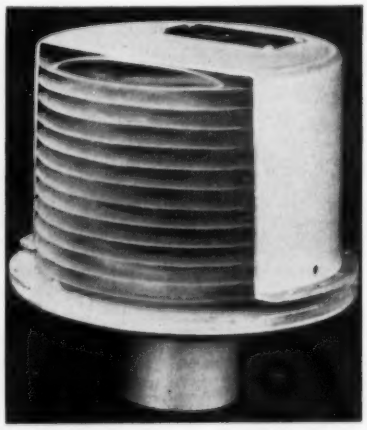
The tunnels will be 14 feet wide and 15-½ feet high. They will be driven some distance inside the footwall and hangingwall but parallel to the ramp. The longer tunnel, in the footwall rock, will be 1,800 feet long. The other tunnel, 400 feet in length, will be driven in the hangingwall rock. Construction of the longer tunnel has begun and is proceeding at the rate of 100 feet per week. When both are opened to traffic, trucks will move up through the 1,800-foot leg, then come out at the south end of the Open Pit before entering the hangingwall tunnel. A smooth, safe flow of trucks hauling ore from the pit will be controlled by stop-and-go lights at the tunnel portals.

Nylon Bellows Used In Explosion Suppression System

A device for sensing incipient explosions and suppressing them—all within less than a thousandth of a second—relies on the properties of Du Pont's "Zytel" 63 nylon resin for its effectiveness. The suppression system, one of several designed for use primarily in jet aircraft fuel tanks, is activated by a pressure-rate-of rise detector. The rise in pressure caused by the incipient stage of an explosion in a gas tank compresses a bellows diaphragm fabricated from extruded nylon film. This, in turn, supplies current to a small detonator within a capsule containing a suppressant agent, generally bromochoromethans. When the detonator goes off, the suppressant is scattered as a mist, rendering inert the unburned vapors around the expanding flame front and aborting the explosion. Because of the time element involved, the response time of the bellows must approach zero. Of all the materials tried, nylon was the only one found suitable for this application.

The explosion suppression system is based on the fact that, in the initial stages of any explosion or fire, the rise in pressure is not instantaneous, but occurs over a period of perhaps three of four milliseconds. During this brief time suppressants can effectively dampen the explosion before it does damage.

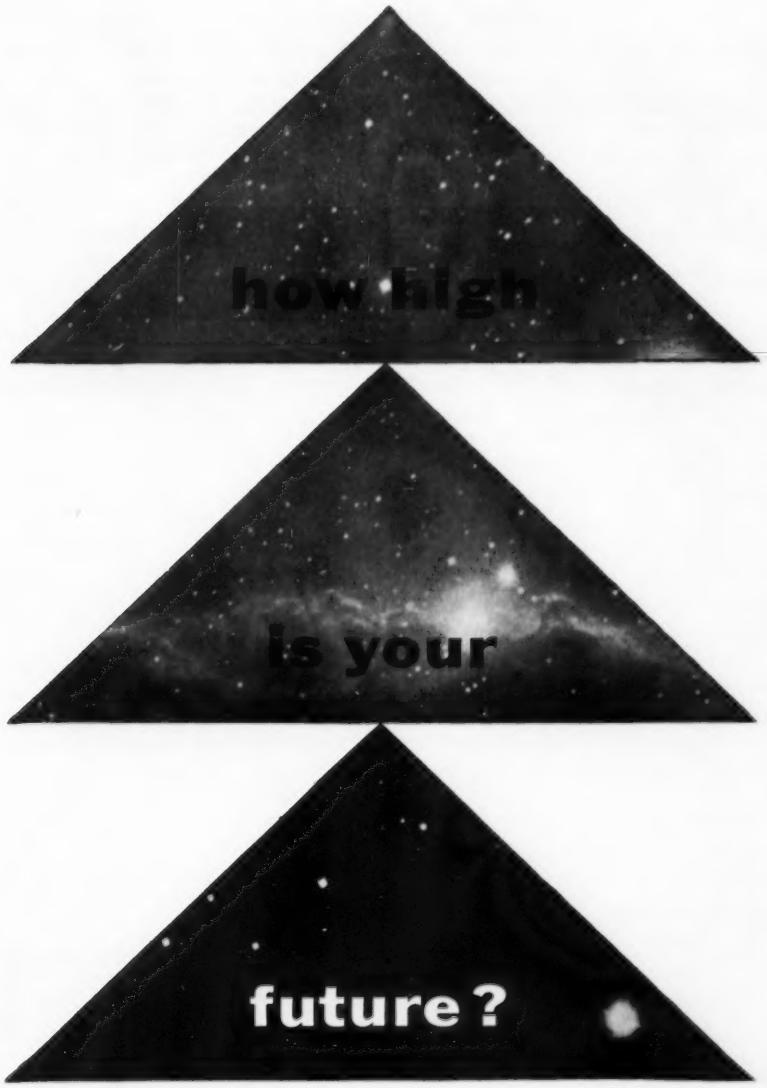
Finding a bellows material sufficiently sensitive to operate within this limited period and which, at the same time, would not deteriorate in the presence of jet fuel vapors, was a major design problem to Simmonds Aerocessories, Inc., makers of these suppression systems. The problem was overcome with the assistance of the Plastex Process Company, who suggested the use of "Zytel" 63 nylon resin. Bellows of "Zytel" fabricated by Plastex were found to be immediately responsive to pressure changes due to its low inertia, resulting from its resilience and low specific gravity. At low temperatures (-65°F.) "Zytel" was the only material which retained its resiliency and low spring rates. In addition, the resistance of "Zytel" to corrosion and its ability to withstand the operating temperatures in jet fuel tanks made it practical for this application.



Systems are already installed in production jet aircraft and are providing effective protection against the danger of fuel explosion.

Suppression systems have also been installed successfully in a

(Continued on page 46)



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If you're on the way up – and going far . . . if you are willing to apply your ability to the toughest engineering challenge . . . you'd do well to look into the Martin story.

No matter *how limited* or extensive your background, there will always be openings on the Martin team for the engineer who has what it takes to go *higher*.

Contact your placement officer or J. M. Hollyday, The Martin Company, Baltimore 3, Maryland.

MARTIN
BALTIMORE

Technibrief

Continued from page 44)

number of non-aircraft industrial applications. The manufacturer regards them as a promising safety device for use with high speed printing presses, fuel test cells, flour mills and other areas where hazards due to explosive atmospheres exist.

New Film For Television Stations

A new film and slide system for television stations is now in commercial production. Designed primarily for color film and slide programming by the General Electric Company, the new system may be installed initially to handle monochrome film and slides.

The new equipment uses a continuous motion projector, developed by the Eastman Kodak Company for use with the system's electronic flying spot which is its light source and film scanner.

Outstanding features of the system are its freedom from registration problems, high light level and automatic, mechanical and optical, shrinkage control. These features are considered highly desirable because they allow the broadcaster to program a wider variety of color film.

According to GE engineers, the optical system, which uses highly efficient rotating mirrors, affords many times more light than any other flying spot scanner system and gives a crisper, brighter, cleaner picture with a minimum amount of noise.

GE engineers have also said that the effects of dust and dirt, which cause a "rainlike appearance" on home sets, present no problem with the new equipment because the mirrors used in the projector are isolated from the film and are not near the focal plane.

The continuous motion projector, on which the new system is based, represents a notable achievement in the art of projecting color film. It makes possible lap-dissolves from one frame to the next by means of a unique rotating mirror system.

Coupled with the continuous motion projector is the flying spot projecting light through both black and white and color film because it is a controllable and reliable light source.

According to GE engineers, the combination of the flying spot scanner system, the highly efficient mirrors and the special f:1:6 lens is sufficient to provide ample light for a clean, bright and crisp picture from even the most dense and difficult color film.

The continuous motion projector uses highly efficient mirrors to cause the film to appear stationary. This allows the system to be started or stopped on any frame without synchronizing the movement of the film with the field rate before the picture is telecast.

With the film traveling continuously at all times, fast pull-down claws and intermittent sprockets are eliminated. Sprocket hole and film damage is thereby minimized along with the splicing problem

(Continued on page 48)

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It's about time you bought yourself a Cornell warm-up jacket! They're made of fine wool melton with knit trim.

Choose either Maroon, with maroon and white knit collar, cuffs and waistband, CORNELL in white felt block letters across the back—**$15.95**

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NEW **DEPARTURES OF TOMORROW**

TOMORROW: You dictate! The machine types and hustles your letters to the mail. Electronics does it all.

TODAY: In dictating instruments, New Departure ball bearings contribute to compactness of design and operating efficiency. They hold moving parts in alignment—reduce wear—require no upkeep.

Think of dashing through your correspondence with this imaginary scribe! It converts your voice into electronic impulses which **type, micro-record, fold, insert, seal, address and stamp letters** almost as fast as you can dictate!

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NEW DEPARTURE

BALL BEARINGS

NOTHING ROLLS LIKE A BALL

Technibrief

(Continued from page 46)

normal with most intermittent projectors.

Operationally, the equipment has no difficult color adjustment. Framing is accomplished by electronically moving the raster on the scanning tube rather than manual framing at the picture gate. Fine framing is performed at the projector control panel. Coarse framing is set at the factory and needs no adjustment in the field.

Each film and slide scanning channel has its own flying spot scanner as a light source. This feature insures the broadcaster that the entire system will not be out of operation if one of the light sources fail.

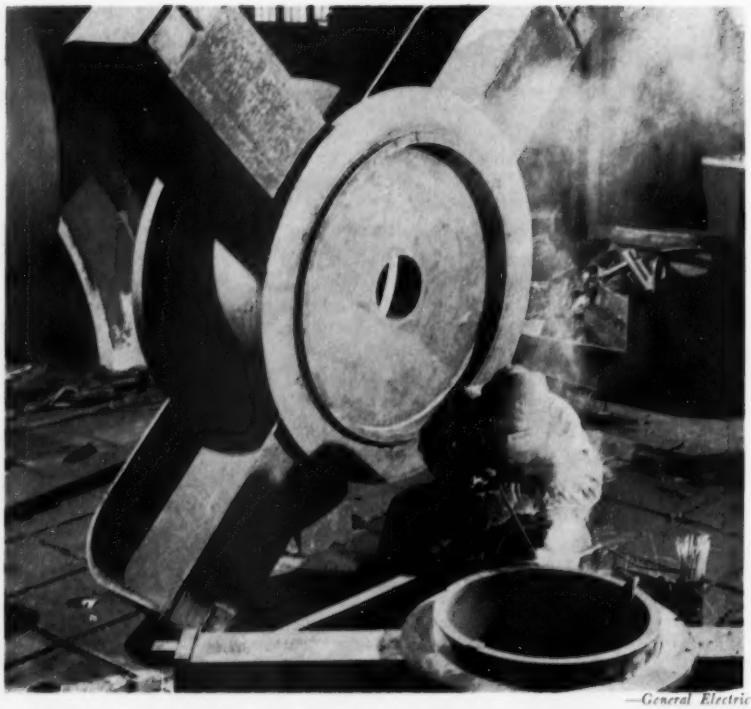
Metallurgical Developments

A new grade of stainless steel containing little or no nickel has recently been developed. Research on the project was done by Dr. Dennis J. Carney, a metallurgist who is Superintendent of No. 2 Electric Furnace Department at U. S. Steel's South Works in Chicago, Illinois. A patent application has been filed on the new product which was developed through studies aimed at conserving nickel, currently in short supply.

It seems that more nitrogen is used in the nickel-free and low nickel stainless steels than was thought possible prior to the study, but, by the proper adjustment of the chemical composition of the steels, particularly with regard to the chromium and manganese contents, sound ingots can be made with a nitrogen content of more than double the old limit. This discovery opened the door to an entirely unexplored area for a reduction in the use of nickel.

Despite these discoveries, further work is necessary to establish more carefully the corrosion, welding and high-temperature properties of these high-nitrogen steels.

It is also necessary to solve several rolling and finishing problems. It is expected, however, that these problems will be resolved in the near future. If so, the way may be opened to a further marked increase in stainless steel production and application. A new grade of austenitic stainless steel has been developed with special fields of application and not merely as a substitute for presently used grades during periods of nickel shortage.



—General Electric

A welder, using General Electric's new Strikeasy LH-1 low hydrogen electrode, joins heavy metal parts in an eastern manufacturing plant. The electrode claims faster and easier operation than conventionl low-hydrogen types.

Another recent development in the field of metallurgy is General Electric's recently built Strikeasy LH-1 low-hydrogen electrode. This electrode is to be incorporated into a welder. The electrode will enable the welder to join heavy metal parts faster and easier than conventional low-hydrogen types.

Alumni News

(Continued from page 31)

Bakelite Co., a division of Union Carbide & Carbon Corp., has announced that **Bill Gay C.E. '40**, 641 Metape East, Bound Brook, was made service superintendent of Bakelite's River Road plant, November 1. Bill, is married to **Marjorie Elliott '42** and they have two children, Patricia, 14, and Margaret, 8.

Bill joined Bakelite in 1941 after a year's service with National Carbon Co., another division of Union Carbide located in Cleveland, Ohio. His assignment to the company's polystyrene and formalin division as assistant superintendent was interrupted by four years' service in the Field Artillery during World War II. Following his release from the service as a captain, he served in a number of engineering assignments before assisting the department heads in the vinyl and polyethylene fabrication department in 1948. He was appointed assistant superintendent in charge of that operation in 1952 and held that assignment 'til the first of the year, when he was named assistant superintednent of the polytyrene and formalin division.

—Alumni News

Bill Gay, C.E. '40

HOW HERCULES HELPS...

AN INCREASED SUPPLY of para-cresol, raw material for antioxidants used in gasoline and rubber, will become available late in 1956 with the completion of the recently announced addition to Hercules' oxychemical plant in Gibbstown, N. J. This will more than double the amount now being produced by Hercules and is the sixth product to be made commercially by the Hercules' oxidation process. Para-cresol also plays an important part in the production of essential oils and in the manufacture of dyes.

FASTEST DRYING of all protective coatings, lacquer is ideally suited to keep pace with today's mass production methods. At the Standard Box Company in Pittsburgh, for example, a single-application hot-lacquer system protects beverage boxes with no delays for drying. Hercules works closely with the coatings industry in developing and perfecting new uses for lacquer-type coatings based on its nitrocellulose, ethyl cellulose, cellulose acetate, and Parlon® (chlorinated rubber).

ACID, ALKALI, AND WATER are all repelled when paper or paperboard are sized with Hercules Aquapel®. In corrugated cartons or spiral wound fiber drums where alkaline glues are used, Aquapel sizing effectively retards penetration of the glue. Neither a resin nor a wax, Aquapel is a chemical that reacts with the cellulose fiber to form a surface that is resistant to hot and cold water, acid or alkali. That's why so many paper mills are finding ever-increasing use for this new sizing agent.

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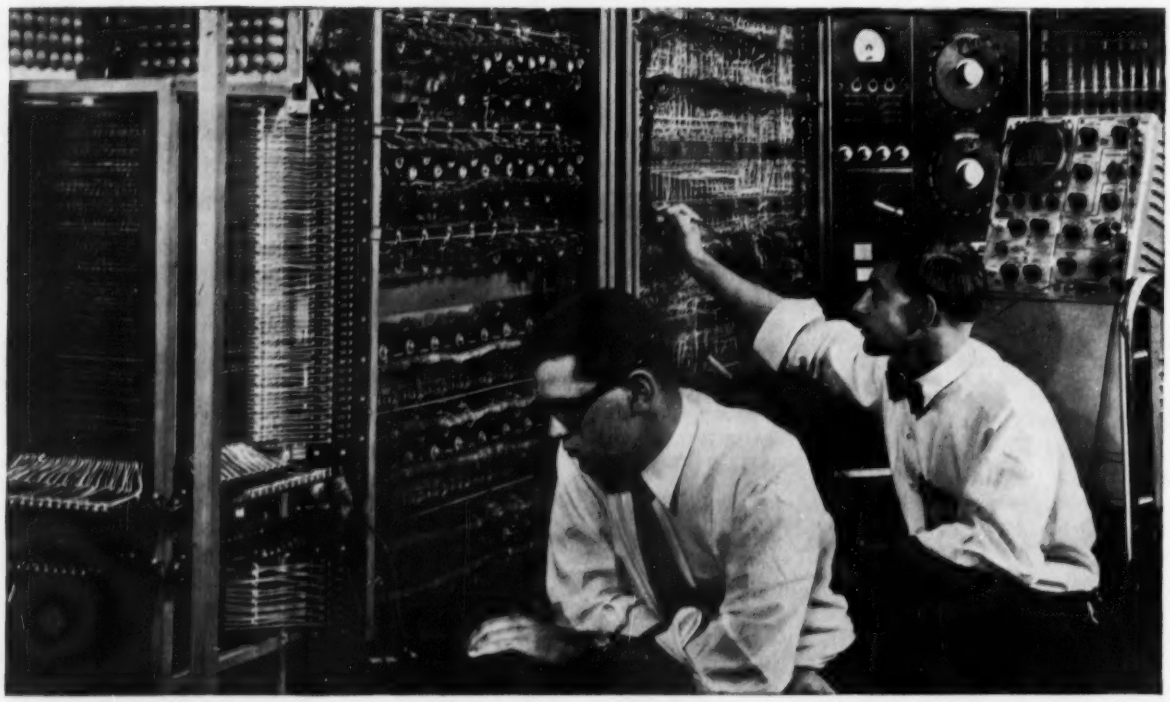
(A message from IBM*—where progress is engineered)*

THIS FIELD IS AS YOUNG AS YOU ARE

One of the best growth opportunities for a young engineer today lies in the new and rapidly expanding field of digital computer development and design.

The rapid progress which electronic giants have achieved in business, science, and government is dwarfed by their *potential*. Fulfillment of this potential offers unusual challenge to an engineer's ingenuity.



Young engineers have made substantial contributions to IBM's recognized leadership in computer development and design. For example, the average age of the engineering team which built the famous 701 computer was only 28! Young IBM engineers also play important roles in solid state materials research and in the development of advanced computer components.

At IBM, engineers enjoy a climate which encourages achievement—eminent associates, advanced facilities, creative freedom. Out of this climate has grown a tradition of engineering excellence.

Should you choose computer engineering as a career, what more logical place to start than with the leader? At IBM, you will have unrestricted professional opportunity.

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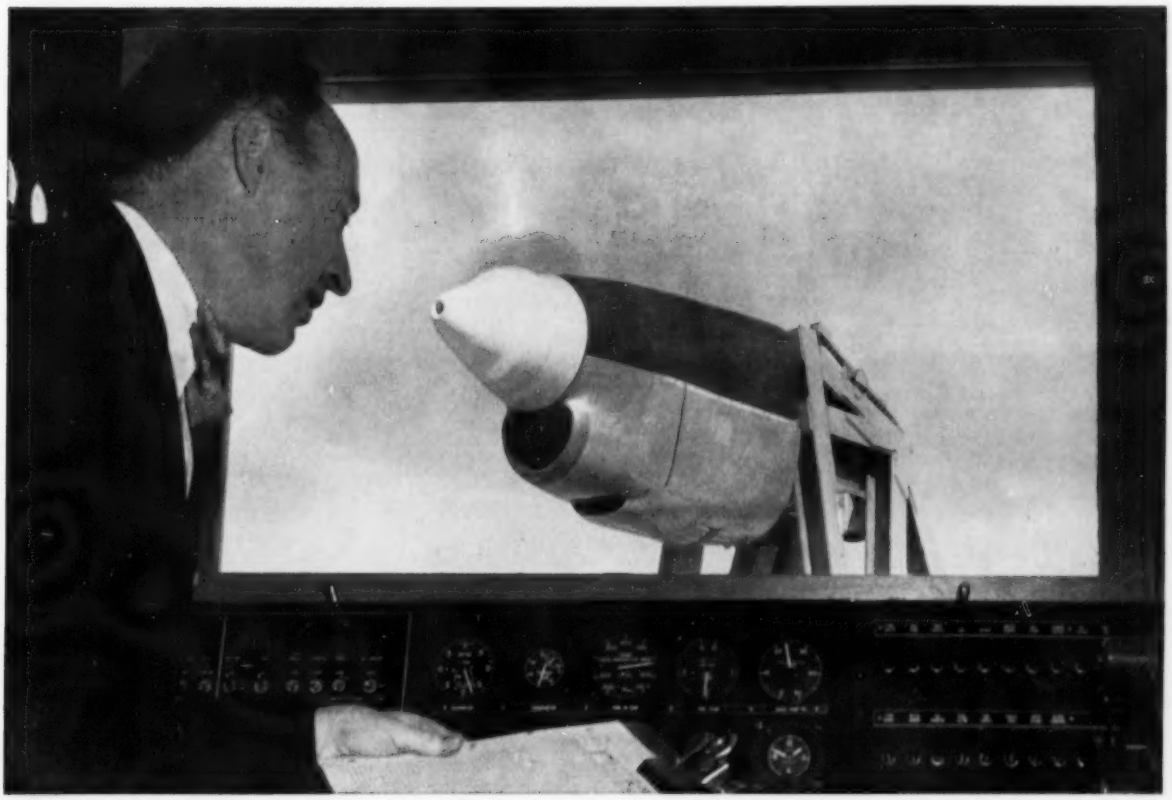
16 TIMES "AROUND THE WORLD" AND NEVER OFF THE GROUND!



WHAT KIND of double talk is that—"16 Times Around the World, and Never Off the Ground?"

It's like this. With Allison's entry into the commercial airline field, there is a need for flight data on turbo-prop engines before they are put into regularly scheduled commercial service. In the absence of actual data, Allison is running a 1000-hour test schedule with a Model 501 turbo-prop engine mounted on an outdoor test rig.

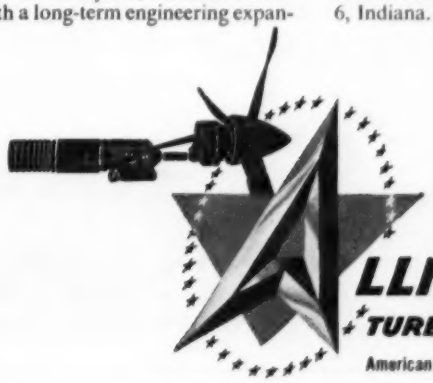
In reality, 1000 hours of flying time represents about 16 times around the earth, is the equivalent of about 4 months of normal, commercial airline usage.

For this test, actual airline operating schedules are used. This means that the engine is run through complete cycles of starting, ground idle, take-off, climb, cruise and descent for landing, and the cycle is repeated continuously 'round the clock as the schedule simulates trips of from 250 to 2500 mile blocks.

One of the young engineers who has been working on the project from the start is Donal J. Nolan, shown above at the test instrument control panel. Don is assistant chief, installation engineering at Allison. After his graduation in '42 from Case Institute of Technology, he came to General Motors in 1943 with a degree in ME.

Commercial acceptance of the Allison turbo-prop engine started with the purchase of a quantity of Allison-powered Lockheed Electras by American Airlines. This initial purchase, plus plans of other leading airlines to adopt the Electra, opens a new chapter in the growth and development of Allison Division of General Motors Corporation. Already a leader in the design, development and production of turbo-jet and turbo-prop engines for military use, Allison is underway with a long-term engineering expansion program covering advanced military and commercial engine installations. This $75,000,000 program, providing for newest engineering and research facilities, intensifies the *immediate* need for engineers.

Opportunity for young graduate engineers is unlimited at Allison. Arrange now for an early interview with our representatives on your campus, or write now for information about the possibilities of YOUR engineering career at Allison: R. G. GREENWOOD, Engineering College Contact, Allison Division, General Motors Corporation, Indianapolis 6, Indiana.



ALLISON
TURBO-PROP ENGINES
American built for the new era in air travel

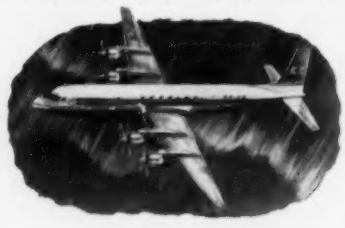
F4D, "SKYRAY"— only carrier plane to hold official world's speed record

A4D, "SKYHAWK"— smallest, lightest atom-bomb carrier

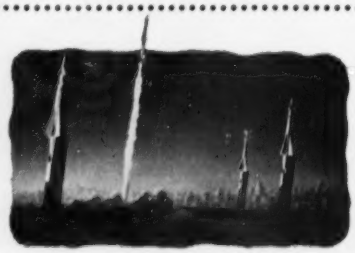
RB-66 — speedy, versatile jet bomber

A3D, "SKYWARRIOR"— largest carrier-based bomber

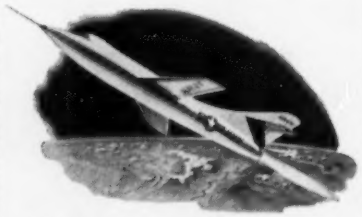
C-124, "GLOBEMASTER"— world's largest production transport



DC-7 "SEVEN SEAS"— America's finest, fastest airliner



"NIKE"— supersonic missile selected to protect our cities



D558-2, "SKYROCKET"— first airplane to fly twice the speed of sound

Engineers: join this winning team!

At DOUGLAS you'll be joining a company in which the three top executive officers are engineers... you'll be associated with men who have designed the key airplanes and missiles on the American scene today! Nothing increases an engineer's ability faster than working with other engineers of top calibre.

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For further information relative to employment opportunities at the Santa Monica, El Segundo and Long Beach, California divisions and the Tulsa, Oklahoma division, write today to:

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Precision, high-speed winding equipment for IRC elements

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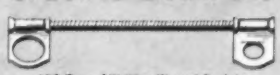
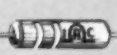
Wire element is uniformly and tightly wound on an insulated core. Axial leads or other terminations are secured to element by automatic machinery. Insulated housing may be used or omitted.

SPECIFIC EXAMPLES

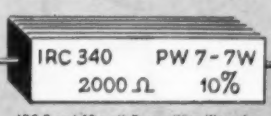


IRC Type AW Wire Wound Resistors



IRC Type BW Insulated Wire Wound Resistors

IRC 4-watt Insulated Power Wire Wounds



IRC 7 and 10 watt Power Wire Wounds

IRC WINDING SKILL OFFERS REALISTIC SAVINGS TO INDUSTRY

. . . another reason why engineers specify IRC Resistors

Savings in the initial cost and assembly of component parts are an increasingly important factor to electronic engineers. That's why they depend upon IRC for their resistor requirements. IRC's mastery of winding wire elements—dating back more than 25 years—today provides a wide variety of unique units that offer realistic possibilities for savings.

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Brain Teasers

Mathematicians who wait twenty minutes for the bus must like neither Mozart nor whiskey. We came to this conclusion last month all alone, because no correct answers from readers seemed to be forthcoming. Fortunately, however, Mr. Howard Lefkowitz, Arts '58, whose picture appears, sent us his answer (the only correct answer among two dozen which ultimately arrived) just before last month's issue was published. We have supplied Mr. L. with the $3.00, as promised.

Howard Lefkowitz, Arts '56

The same situation seems to be developing at this time with the clock problem from last month. This is *not* a trivial problem, and, to allow time for people to fully figure it out, we refrain from printing until next month the correct solution. Won't let it drag on any longer than that, though.

For this month we have (1) a Boolean problem, (2) a family problem, and (3) a hat problem. The Boolean problem is for fun, and, although the conclusion is obvious without much thought, it is hoped that readers will attempt to apply the rules of symbolic logic outlined in the December, 1955, issue. Problems (2) and (3) are for contest, and both may be correctly solved and sent to the ENGINEER by anyone aspiring to win the January brain teasers $3.00 prize.

The following requirement should be observed, please, with regard to submitted solutions: Clearly show, in full, your method of obtaining your result. Henceforth, correct answers obtained by shady methods or by unstated methods will not be distinguished from incorrect answers. (The editors are misanthropic.)

Here are the January problems:

1. Deduce all logical consequences of the following three propositions:
   (a) No unreasonable man is simple.
   (b) Some men do more work than they do study.
   (c) Every man who does more work than he does study is an unreasonable man.

2. There are now four children of unequal ages in a certain family and the sum of their ages is 28. Four years ago the sum of the ages of the children in the family was 13, and seven years ago the sum of the ages was five. If the oldest child was a year older than the next to the oldest, then what is the age of the oldest child?

3. Three mathematicians, in prison for certain reasons, are offered by their jailor the opportunity to escape, provided at least one of the three is able to solve this problem:

The jailor had five hats, of which two are black and three are white. From the five hats, the jailor chose three (one for each mathematician) and while the prisoners were not looking placed one hat upon each of their heads. Then the jailor requested that each mathematician, able to see the hats of the other two but not his own, state, if he could, the color of the hat he wore.

The first men, looking at the second and third, was unable to say, Similarily, the second man was unable to give an answer. However, the third man (who incidentally was blind) gave the correct answer, and the mathematicians were released.

The question is: How did the third mathematician know what color his hat was? What color was it? Remember that men are mathematicians, so that, for example, the failure of the first and second men to answer was not due to failure to reason properly. The answer of the third man was not a guess.

Hughes-equipped T-29 "flying laboratory" for systems evaluation.

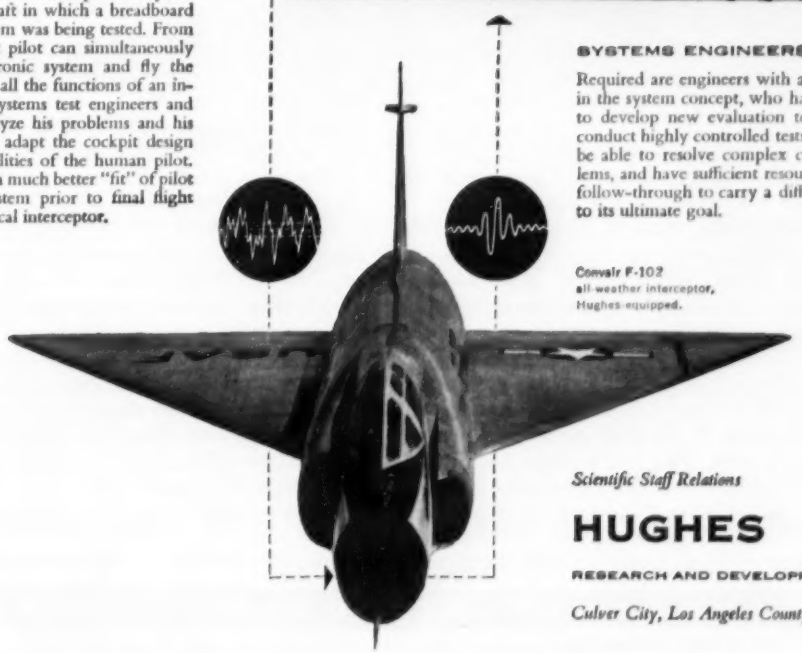
Flight evaluation of advanced interceptor electronic system uses unique approach.

T-29 "INTERCEPTOR"

THE DEVELOPMENT OF AIRBORNE ELECTRONIC SYSTEMS REQUIRES THOROUGH FLIGHT EVALUATION OF BREADBOARD AND PROTOTYPE EQUIPMENT PRIOR TO FINAL DESIGN. AT HUGHES, SYSTEMS FOR INTERCEPTORS ARE FIRST TESTED IN "FLYING LABORATORIES" IN WHICH THE EQUIPMENT IS READILY ACCESSIBLE TO SYSTEMS TEST ENGINEERS

One interesting problem recently confronting Hughes engineers was that of evaluating the requirements imposed upon the pilot of a high-speed one-man interceptor. This arose in the development of a new integrated electronic system to control several phases of an all-weather interceptor's flight. Because of the great importance of providing the pilot with the optimum design and arrangement of displays and controls, it became necessary to determine accurately the pilot's work load during flight, and the human factors that affect his ability to carry out his task.

The solution was to install a complete mock-up of the actual interceptor cockpit in a large T-29 aircraft in which a breadboard model of the system was being tested. From this cockpit a test pilot can simultaneously operate the electronic system and fly the T-29, performing all the functions of an interceptor pilot. Systems test engineers and psychologists analyze his problems and his performance, and adapt the cockpit design to the natural abilities of the human pilot. The result will be a much better "fit" of pilot and electronic system prior to final flight testing in the tactical interceptor.



Convair F-102 all-weather interceptor, Hughes-equipped.

SYSTEMS ENGINEERS

Required are engineers with a basic interest in the system concept, who have the ability to develop new evaluation techniques and conduct highly controlled tests. They should be able to resolve complex circuitry problems, and have sufficient resourcefulness and follow-through to carry a difficult program to its ultimate goal.

Scientific Staff Relations

HUGHES

RESEARCH AND DEVELOPMENT LABORATORIES

Culver City, Los Angeles County, California

Because we'll never give this bird a chance,

your future is bright at PPG

The "look-where-I've-been-bird" flies backward. He isn't interested in where he's going . . . just where he's been. That's why he will never roost at Pittsburgh Plate Glass.

With its impressive record of growth to add to past laurels, PPG continues to move forward. Emphasis is on research to open new markets with new products . . . and to expand existing markets with improved present products. PPG's growth has been tremendous in paint, glass, chemicals, plastics, fiber glass and brushes. Its future is bright. It needs promising college graduates to share in future growth.

In the past 12 months PPG has undertaken a major expansion and modernization of its research facilities. A few examples of this: a paint and plastic laboratory was opened at Springdale, Pa.; a glass research center is underway at Harmarville, Pa.; and a major chemical laboratory is being planned. The company now devotes approximately $9,000,000 annually to research and product development programs exclusive of capital expenditures.

Nearly 1000 people are employed by PPG in research and development. This means one research person for nearly thirty employees in production, maintenance, distribution, administration and sales.

Pittsburgh Plate Glass Company, with an enviable business reputation dating back nearly three-quarters of a century, is constantly looking and moving ahead. That's why opportunity is so great in a vast number of fields at PPG.

PPG wants and needs college graduates of promise. If you think you would like to become part of this progressive, alert organization, write today for more information. Just address Pittsburgh Plate Glass Company, General Personnel Director, One Gateway Center, Pittsburgh 22, Pennsylvania.

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REFRACTORY CRUCIBLES
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From the Following Materials:—

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Write now for information about CONVAIR'S interest in Engineering graduates.

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A DIVISION OF GENERAL DYNAMICS CORPORATION

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An enlarged reprint of the above cut-out silhouette, suitable for framing or pinning up, will be sent free to any engineering student on request.

Engineering is more than a department at the Timken Company—it's everything!

That's why we offer such a promising future for graduate engineers

FEW companies can offer engineering and metallurgy graduates such a wide variety of opportunities as you will find within the Timken Company. And we are constantly seeking college graduates who have specialized in these fields because every phase of our manufacturing, research, and marketing requires advanced technical skills and training.

PROMOTIONS MADE FROM WITHIN There is an unusual opportunity for you to advance in the Timken Company. This is highlighted by the fact that one hundred percent of the men in executive and supervisory positions, including the president of the company, have risen from the ranks. And most of these key men are graduate engineers or metallurgists.

MANY FINE TECHNICAL OPPORTUNITIES The Timken Company offers a splendid opportunity to every graduate in one of the many specialized spheres of the company's operation. These include research and development in tapered roller bearings, alloy steel, and rock bits; production of fine alloy steel; metallurgical testing, quality control, and technical service; bearing design and manufacturing control; bearing application engineering for aircraft, automotive, agricultural, railroad, industrial, and other fields; rock bit design, forging, and heat treatment; and sales engineering, covering development work in every market where Timken bearings, steel, and rock bits are used or have a potential.

Another especially important part of engineering work at the Timken Company is the design of plants and specialized equipment for making Timken Company products better and faster. An outstanding example is our revolutionary new, completely automatic bearing plant now in operation in Bucyrus, Ohio.

SOLVE PROBLEMS FOR ALL INDUSTRY You can be assured of an interesting and stimulating career with the Timken Company because of the diversity of applications into which our products go. Every industry is a user of these products. That means that Timken Company engineers and metallurgists are constantly involved in solving problems and designing for new applications in fields far removed from their own drafting table or laboratory bench. We believe that this opportunity to play a part in the advancement of *all* American industry is an important reason why technically trained graudates like being on the Timken Company team.

RECORD OF PIONEERING, PROGRESS The Timken Company was founded 56 years ago. Since then, it has grown to become the world's largest manufacturer of tapered roller bearings and removable rock bits, and a foremost producer of fine alloy steel bars, billets and seamless steel tubing. Our unique combination of experience and research has built an enviable reputation for solving difficult problems for our customers. By constantly expanding and strengthening our technical staff with aggressive and imaginative young engineers and metallurgists, we intend to continue our record of pioneering and progress. And if you possess the abilities and qualities we need, we'll be happy to have you share in that progress.

SEND FOR MORE INFORMATION For more detailed information about The Timken Roller Bearing Company, its training program, and the career opportunities for you, write to the college relations manager for your free copy of the booklet, *"This Is Timken"*.

The Timken Roller Bearing Company

Canton 6, Ohio

TAPERED ROLLER BEARINGS • ALLOY STEEL & SEAMLESS TUBING • REMOVABLE ROCK BITS

How To Start Your Car By Remote Control

by TOM REED, ME '56

Tired of being frozen stiff while you wait for your car to warm up? Here's a remote control starter that you can build and install with ease; one that requires no listening or watching to see if your machine is really running or if it's on fire instead.

This gadget necessitates a four-wire connection between home and car which can be realized by phono plugs somewhere on the outside or a plug to fit into a control box inside the car. The device operates as follows: (See Fig. 1).

The operator pushes normally open momentary contact S_1. This will energize coil M_1, thus closing the two contacts labeled M_1. (M_1 is a DPST heavy duty relay, normally open, rated at 110v AC). This allows current to flow out to the car, energizing M_2 and the solenoid. The former is another DPST 110v AC relay, normally open, medium duty, and when energized connects the battery to the ignition and starting solenoid systems. Thus the engine starts to crank. At the same time the solenoid shown here is actuating the throttle and choke linkage, actual size and position depending on your car.

When the engine catches hold, the generator (marked G here) will begin to turn out six (or twelve) volts. As a result, M_3 (DPST 6 or 12 v DC relay) will be energized, connecting the battery to the ignition and accessories in preparation for the idling condition. At this time the generator will also energize M_4 (SPST normally closed 6 or 12 v DC relay) killing the AC circuit, opening M_1 and M_2, and as a result, stopping the cranking. Red light L_1 indicates cranking, green L_2, idling. Momentary contact normally closed switch S_2 may be used to stop the cranking if the car won't start, and S_3, as a safety precaution, must be closed in order to operate the device.

The net effect, then, is to push one button and look at the green light to see if your car is idling. Simple, and certainly makes the early morning trip up the hill easier for yourself and your car. Surprising thing is that it really works, too.

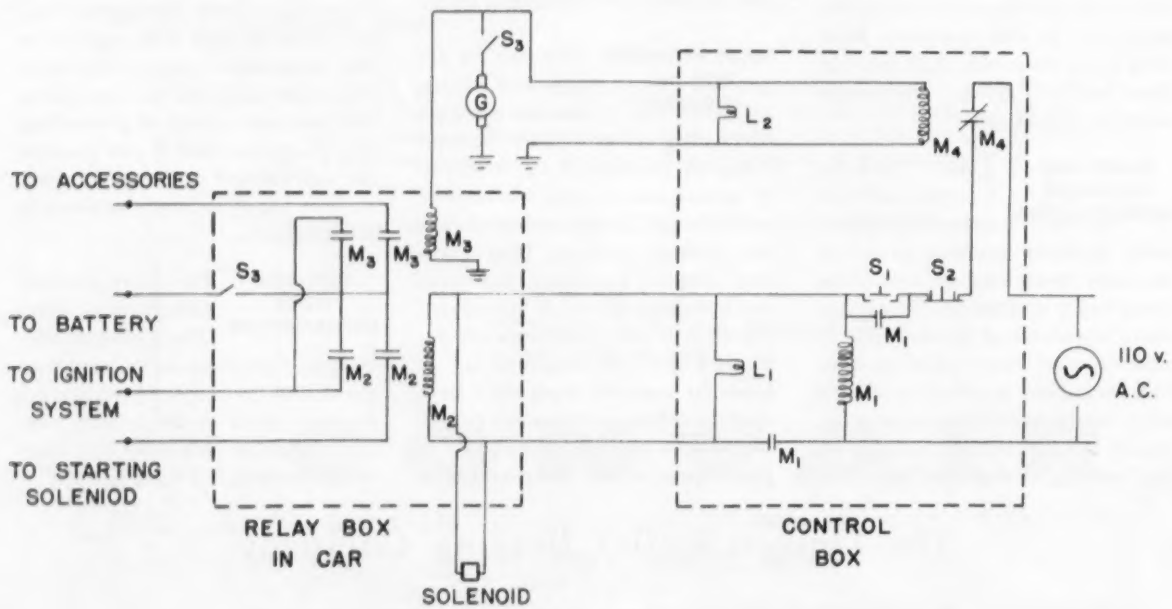


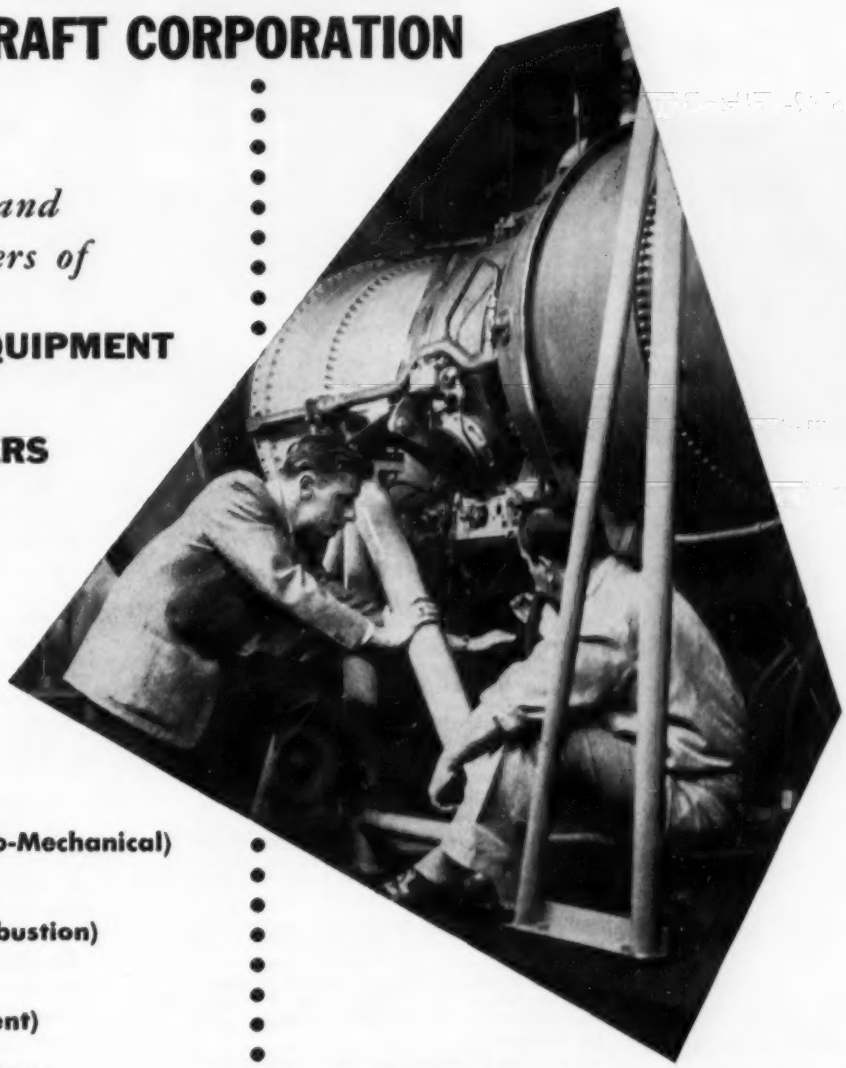
FIG. 1

Openings for Engineers at

HAMILTON STANDARD DIVISION
UNITED AIRCRAFT CORPORATION

Designers and Manufacturers of

JET AIRCRAFT EQUIPMENT AND PROPELLERS



- **Jet Fuel Controls (Electronic and Hydro-Mechanical)**
- **Jet Turbine Starters (Pneumatic and Combustion)**
- **Hydraulic Pumps (Variable Displacement)**
- **Air Conditioning Systems (Air Cycle and Vapor)**
- **Controls and Accessories for Nuclear Engines**
- **Propellers (for Turbine and Piston Engines)**

Engineering Staff Continuously Expanded for the Past 30 Years — and Still Growing.

Largest New Jet Aircraft Equipment Development Program in Our History.

Local Graduate Study Program with R.P.I. Available — Liberal Tuition Assistance.

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For descriptive booklet and additional information, write to Mr. T. K. Bye, Engineering Dept.

HAMILTON STANDARD

UNITED AIRCRAFT CORPORATION

HAMILTON STANDARD DIVISION

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APPLICATIONS are now being accepted for...

1956

graduate student summer employment program for...

Experimental Physicists	Analytical Chemists
Nuclear Physicists	Inorganic Chemists
Theoretical Physicists	Physical Chemists
Mathematicians	Mechanical Engineers
Metallurgical Engineers	Electrical Engineers (Electronics)

Summer employment opportunities at the Laboratory are open to approximately 100 graduate students majoring in various physical sciences, and undergraduates receiving their degrees next June who intend to continue their advance studies.

The program provides for well-paid summer work with renowned scientists in one of the nation's most important and finest equipped research laboratories.

Summer employees will become familiar with several phases of vital scientific research and development activity related as closely as possible to the individual's field of interest. This experience will enable students to appraise the advantages of a possible career at the Laboratory.

In addition to interesting work, employees will enjoy delightful daytime temperatures and blanket-cool nights in a timbered, mountainous area, only 35 miles from historic old Santa Fe.

Interested students should make immediate inquiry. Completed applications must be received by the Laboratory not later than February 1, 1956, in order to allow time for necessary security clearance. Applicants must be U. S. citizens.

Mail inquiry to:
Department of Scientific Personnel

los alamos scientific laboratory
OF THE UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO

Alumni News

(Continued from page 48)

—*Alumni News*

R. P. Heath, M.E. '11

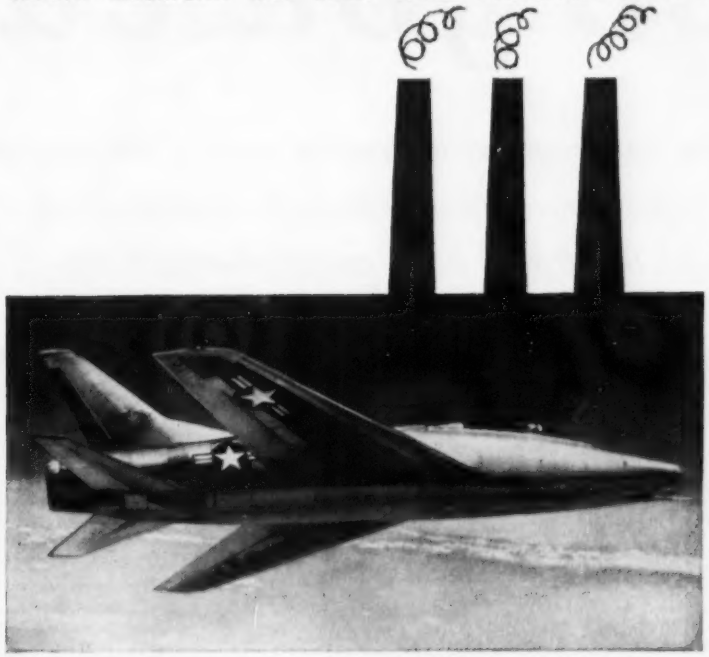
Raymond Pearce (Whisper) Heath, M.E. '11, (above with license plate), underwriter-engineer for 33 years until his retirement in '52, is now at 191 Magnolia Drive, Ormond Beach, Fla. He was a chief special aviation mechanic in first war; stepped off the boat in '19 in N. Y. and stayed there with Marsh & McLennan, Inc., underwriters.

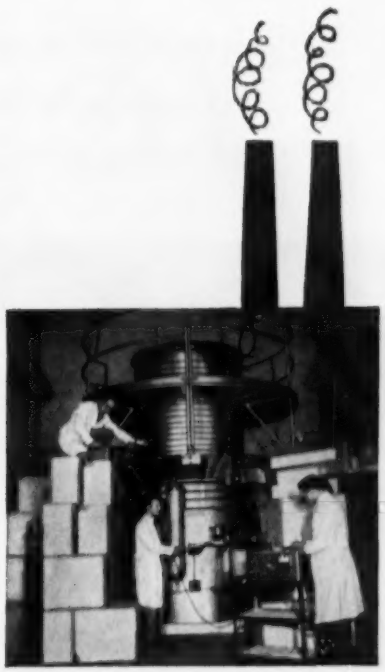
Spencer Kellogg, II., M.E. '37, lives in Glen Head and is the father of five children, including a set of twins. As engineering manager of the aeronautic equipment division of Sperry Gyroscope Co., he is still in the process of producing automatic pilots and aircraft instruments with more value per dollar.

Robert L. Schiffman, B.C.E. '47, has been appointed assistant professor of civil engineering at Lehigh University, Bethlehem, Pa. He was formerly an instructor at Columbia University, where he received the MS in civil engineering in 1951.

Charles W. Hubbell, M.E. '07, a retired consulting engineer who lives at 419 Mulberry Street, Room 508, YMCA, Scranton 3, Pa., has been listed in the 1954 edition of Who's Who in Engineering, along with another Scranton resident, **Frederick J. Platt, E.E. '92,** 610 North Webster Avenue.

NORTH AMERICAN HAS BUILT MORE AIRPLANES THAN ANY OTHER COMPANY IN THE WORLD





DIVERSITY CREATES OPPORTUNITY

Although best known for design and production of world-famous aircraft like the Korea-famed F-86 *Sabre* Jet and the new, record-smashing F-100 *Super Sabre* . . . North American Aviation also offers engineers excellent opportunities in other technical fields.

North American needs engineers with imagination to help design and build the aircraft of the future. Other fascinating careers are created daily in its rapidly developing guided missile, jet, propulsion systems, electronic and atomic energy programs.

When you are ready to enter the engineering profession, consider the well-paid opportunities at North American. Meanwhile, write for information on your future in the aircraft industry.

Contact: **Your College placement office or write:**

Engineering Personnel Office
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Los Angeles

12214 South
Lakewood Blvd.,
Downey, Calif.

North American
Aviation, Inc.
Columbus 6, Ohio

ENGINEERING AHEAD FOR A BETTER TOMORROW

NORTH AMERICAN AVIATION, INC.

A job you can

Union Carbide offers you opportunities to grow in some of the most rapidly expanding fields in industry. You may have the qualifications that will help you to "get in on the ground floor" on new developments by the

RADIOISOTOPES — Union Carbide's Divisions are leaders in the field of nuclear research and development. One Division, Union Carbide Nuclear Company, operates for the government Oak Ridge National Laboratory, the Nation's chief source of radioisotopes. In medicine, radioisotopes are used to investigate the human bloodstream —how it supplies nourishment, defends against disease, or becomes diseased itself.

TITANIUM — Electro Metallurgical Company is rapidly completing a new plant to produce titanium, the wonder metal whose strength and lightness are combined with resistance to heat and corrosion. The new plant will use a process developed by Union Carbide research, and will have an annual capacity of 7,500 tons of crystalline sponge —half again as much as the total United States production in 1954.

THE HORIZONS ARE UNLIMITED *for engineers, chemists, physicists, and business and liberal arts majors. Union Carbide offers many opportunities to explore those horizons.*

UCC divisions include . . .

Bakelite Company · Carbide and Carbon Chemicals Company
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Linde Air Products Company · National Carbon Company
Union Carbide Nuclear Company

grow with ...

Divisions of Union Carbide in alloys, carbon products, industrial gases, chemicals, plastics and atomic energy. Examples in four of these growing fields are illustrated below.

PETROCHEMICALS — Carbide and Carbon Chemicals Company produces more petrochemicals than any other company in the world. Some are being used to develop whole families of new adhesives and bonding agents. It is now possible to make almost any materials stick together permanently. Union Carbide research into the nature of bonds—mechanical, chemical, molecular—will make possible new and better adhesives.

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Contact your Placement Director and make appointments with the recruiting representatives of Union Carbide and its Divisions.
For further information, write:

UNION CARBIDE

AND CARBON CORPORATION

Industrial Relations Department, Room 406

30 East 42nd Street UCC New York 17, New York

Here is one of a series of advertisements we are running in FORTUNE and BUSINESS WEEK to acquaint company managements with our interest and our experience in the field of automation and data-processing.

We believe we are making good progress in developing activities that should ultimately give us a strong position in the tremendously important and rapidly growing field of automation.

Positions are available for scientists and engineers in these fields of current activity:

Business Data Systems Development

Digital Computer Research and Development

Radar and Control System Development

Communication Systems Development

Guided Missile Research and Development

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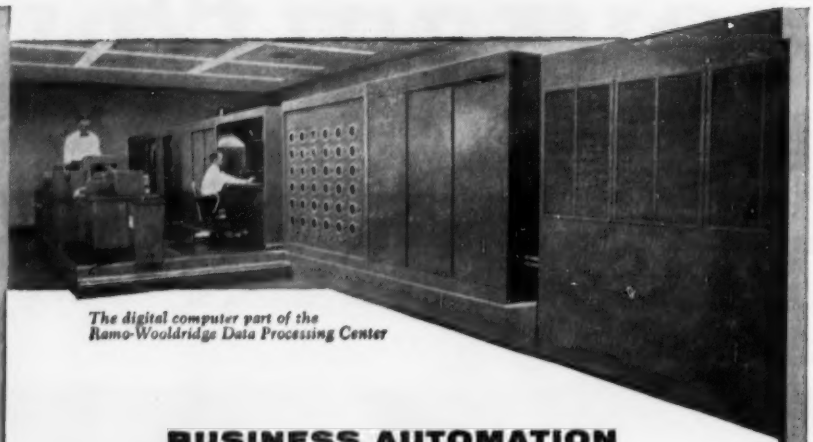


The digital computer part of the Ramo-Wooldridge Data Processing Center

BUSINESS AUTOMATION and MILITARY ELECTRONICS

The problem confronting many company managements today in deciding what course to follow in applying the new techniques of automation and data processing is similar to the problem faced in recent years by the leaders of our military organizations in arranging for efficient application of the same powerful tools of electronics to the art of war.

At Ramo-Wooldridge the difficult demands of major military systems responsibility have been met successfully by the placing of heavy dependence upon teams of unusually well-qualified, mature and experienced scientists, operational procedures experts, and engineers. These teams deal with the technical and non-technical portions of a project as inseparable and interrelated aspects of a single problem.

Similarly, work has been done in the last two years by this company on systems problems of non-military clients from such diverse fields as manufacturing, banking, transportation and public utility. The results strongly support the conclusion that many of the difficult problems in automation that face business and industry today can be economically solved by teams that include a breadth of technical and non-technical competence which permits them to conduct a highly objective, scientific analysis of a client's operations and requirements:

One important advantage to the client of such a broad and objective approach to his problems is the possibility of recommendations that realistic operational needs can be met without the necessity for investment in any additional machines or equipment. Nevertheless, the technical strength of The Ramo-Wooldridge Corporation, provided by its hundreds of scientists and engineers, is such that it can also undertake successfully the development of entirely new equipment and techniques, if required. As an example, major programs are currently under way on the development of an advanced type of digital computer and control system, and on the automation of large-scale data processing activities.

To a surprisingly great extent, military electronics experience has charted the course for non-military automation. A major objective of The Ramo-Wooldridge Corporation is to assist business and industry in moving rapidly, yet realistically and economically, to take advantage of the great benefits of the new techniques.

The Ramo-Wooldridge lecture hall during a lecture on Operations Research, as applied to the solution of management problems.

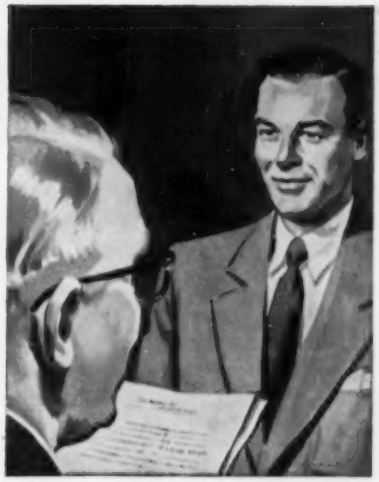
PACIFIC SEMICONDUCTORS, INC., *a subsidiary devoted to the development and manufacture of advanced types of semiconductor devices such as diodes and transistors... of great importance in the future apparatus of automation.*

The Ramo-Wooldridge Corporation

8820 BELLANCA AVENUE • LOS ANGELES 45 • CALIF.

Here's what happens when you take a job with DELCO PRODUCTS

1 When you take a job with Delco Products, you start a career with General Motors—with a division known throughout the world as a leading manufacturer of electric motors, hydraulic shock absorbers, and many other products.



2 You enter into a well-organized training program—a program specifically designed to take full advantage of your particular interests and abilities. You don't just "go back to school." Instead, you *learn* by *doing*, with top-flight supervision.

3 As a trainee you get into every conceivable phase of Delco's engineering operations — engineering laboratory, plant engineering, drafting, sales, processing, standards, quality control. Additional assignments are often made in related departments for broader experience.

4 Training completed, you'll be given a specific departmental assignment. Progress can be made in product development, technical staff operations, sales, or in manufacturing supervision—according to your interests and capacity for future development.

5 With Delco's policy of promotion from within, your opportunities for advancement are virtually unlimited. Not every trainee becomes a supervisor, but some go much farther. Many General Motors top executives today are "graduates" of Delco Products Division.

If this opportunity interests you, sign up for the GM interview on your campus and ask for referral to Delco Products. For booklet detailing Delco's engineering activities, write to:

E. J. Bentley, Supervisor, Graduate Training
Delco Products Division, GMC
Dayton 1, Ohio

DELCO PRODUCTS

DELCO DAYTON OHIO — GM GENERAL MOTORS

Division
General Motors
Corporation
Dayton, Ohio

STRESS and STRAIN...

Oh Engineers with hairy ears,
Designing dams and ditches,
Controlling floods and blowing suds,
And never reaching riches;
When you want fun, your tastes don't run
To graphs and mathematics,
But to the Palms and Theodore Zincks
And Ball-room acrobatics.
You make surveys of waterways,
And plan for irrigation,
But H^2O to gin that's sloe,
You add in moderation.
With stress and strain you ascertain
The ways to make frames rigid,
Then spend the night 'til broad daylight
By making dames less frigid.
Oh, Engineers have hairy ears;
I find them most endearing,
But awfully odd, because by God,
They don't like engineering.

* * *

ROTC Sergeant: "Does your uniform fit satisfactorily?"

Frosh: "Well, the jacket is okay, Sir, but the pants are a bit sung under the armpits."

* * *

Englishman No. 1: "Terribly sorry you buried you wife the other day."

Englishman No. 2: "Had to — dead you know."

* * *

A motorist broke down in a lonely part of Kansan pork country and found refuge for the night in a farmhouse. The next morning, his breakfast was served in a large bowl. As he at he found that he was very popular with a small pig which kept nuzzling him affectionately.

"Wal," was the explanation, "it ain't you the pig likes. It's jest that you're a-using his bowl, mister!"

A college senior dated a young lady from a nearby school a few times. Then some weeks passed and when she hadn't heard from him she sent a telegram: Dead delayed or disinterested?

To which the young man promptly wired back: Hunting, fishing or trapping?

* * *

A lady bought a parrot from a pet store only to learn that it cursed every time it said anything. She put up with it as long as she could, but finally one day she lost patience. "If I ever hear you curse again," she declared, I'll wring your neck."

A few minutes later she remarked rather casually that it was a nice day. Whereupon the parrot promptly said, "It's a hell of a fine day."

The lady immediately seized the parrot by his head and spun him around in the air until he was almost dead.

"Now then," she said, "It's a fine day today isn't it?"

"Fine day!" explaimed the parrot. "Where in hell were you when the cyclone struck?"

* * *

The fog
Comes
On little Cat feet
As you sit for a test
And sits
On silent haunches
Hovering over every desk
And then moves on—
Only sometimes it doesn't.

* * *

Salesman: "This model has a top speed of one hundred miles an hour and she'll stop on a dime."

Prospect: "What happens after that?"

Salesman: "A little putty knife comes out and scrapes you off the windshield."

The math professor was notorious for piling on home work. Finally one harassed student went to him and complained that it was absolutely impossible to do all the assigned problems.

"Here's what you do," suggested the instructor. "Just do half the problems."

The student's face brightened.

"Then," continued the prof, "next semester, when you're repeating this course, you can do the other half."

* * *

"Darling, your eyes are like deep pools of sparkling water; your lips are like two little red rosebuds; your teeth are like the finest pearls; but you have the damnedest looking nose I have ever seen on anything but an African Anteater."

* * *

A young teacher said to her best student, aged seven, "Tommy, if I lay one egg on the table and two on the chair, how many will I have altogether?"

"Personally," answered Tommy, I don't think you can do it."

* * *

Found on a fall registration card: "NAME OF PARENTS: Mama and Papa."

* * *

A gangster rushed into a saloon shooting right and left yelling, "All you dirty skunks get outta here."

The customers fled in a hail of bullets—all except a Scotsman who stood at the bar calmly finishing his drink.

"Well," snapped the gangster, waving his smoking gun.

"Well," remarked the Scot. "There certainly were a lot of them weren't there?"

* * *

The eager relatives gathered for the reading of the will. It contained one sentence: "Being of sound mind, I spent every damn cent I had."

PHOTOGRAPHY AT WORK—No. 18 in a Kodak series

What's their credit rating?

With Photography and Air Mail working together, the Credit Clearing House of Dun & Bradstreet, Inc., speeds vast quantities of information across the country overnight.

A Southern wholesale confectioner had received an order for $10.00 worth of candy bars from the Horsie Hollow Candy Shop. It was a first order, and when the credit manager didn't find the name listed in the Reference Book, he phoned the Dun & Bradstreet office for a report on the venture.

The reporter assigned to the case located the concern on a dirt road, and he took a snapshot of the premises and its busy proprietors which inspired this illustration. He interviewed the owners and wrote a report which was forwarded to the wholesaler.

It informed him that the enterprise was operated as a partnership by two neighbors who were both "eleven years of age and unmarried"—also that "although the owners are men of limited means, they have a high standing in their community." The financial statement indicated assets of $13.25 in merchandise and cash, with a valuation of $35.00 for the building consisting of a remodeled turkey coop.

The partners were reported as experienced with a five-year record of selling lemonade and cookies with their home pantries as the principal sources of supply. There was no indebtedness as their mothers' terms were strictly C.O.D. The wholesaler took a more liberal attitude and shipped on regular terms. The bill was paid in ten days, and the wholesaler opened an account in his ledger for the "Horsie Hollow Candy Shop."

Even if Dun & Bradstreet reporters photographed every business they investigate, it would not be among the biggest uses of photography this famous credit organization employs.

One most important way makes last-minute credit information in the apparel trades available thoughout the country overnight. Current data and analysts' opinions on more than 150,000 apparel retailers are microfilmed, transferred to micro-cards and flown daily to Credit Clearing offices.

It's another example of photography and Recordak microfilming saving time and money. They are working for railroads, banks, oil companies and countless other businesses and industries both large and small.

Behind the many photographic products becoming increasingly valuable today and those being planned for tomorrow lie intriguing and challenging opportunities at Kodak in research, development, design and production.

If you are interested in these opportunities in science and engineering—whether you are a recent graduate or a qualified returning serviceman, write to the Business and Technical Personnel Department.

Eastman Kodak Company, Rochester 4, N. Y.

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Challenging careers in G-E Sales Engineering

Apply engineering backgrounds to solve customers' electrical apparatus needs

To develop your technical background into the customer-contact career most suited to your interests and aptitudes, investigate General Electric's Apparatus Sales Training Program. Professional career outlets include work in one of the Company's nation-wide district offices in *sales, application, installation and service engineering; headquarters marketing; or specialization in a particular apparatus product.*

G.E.'s training program equips you to work directly with customers to determine what design, new development or electrical system will best serve their need. Here, Jack Byrne, Manhattan College '41, is shown presenting competitive engineering features of G-E distribution transformers. 956-4

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